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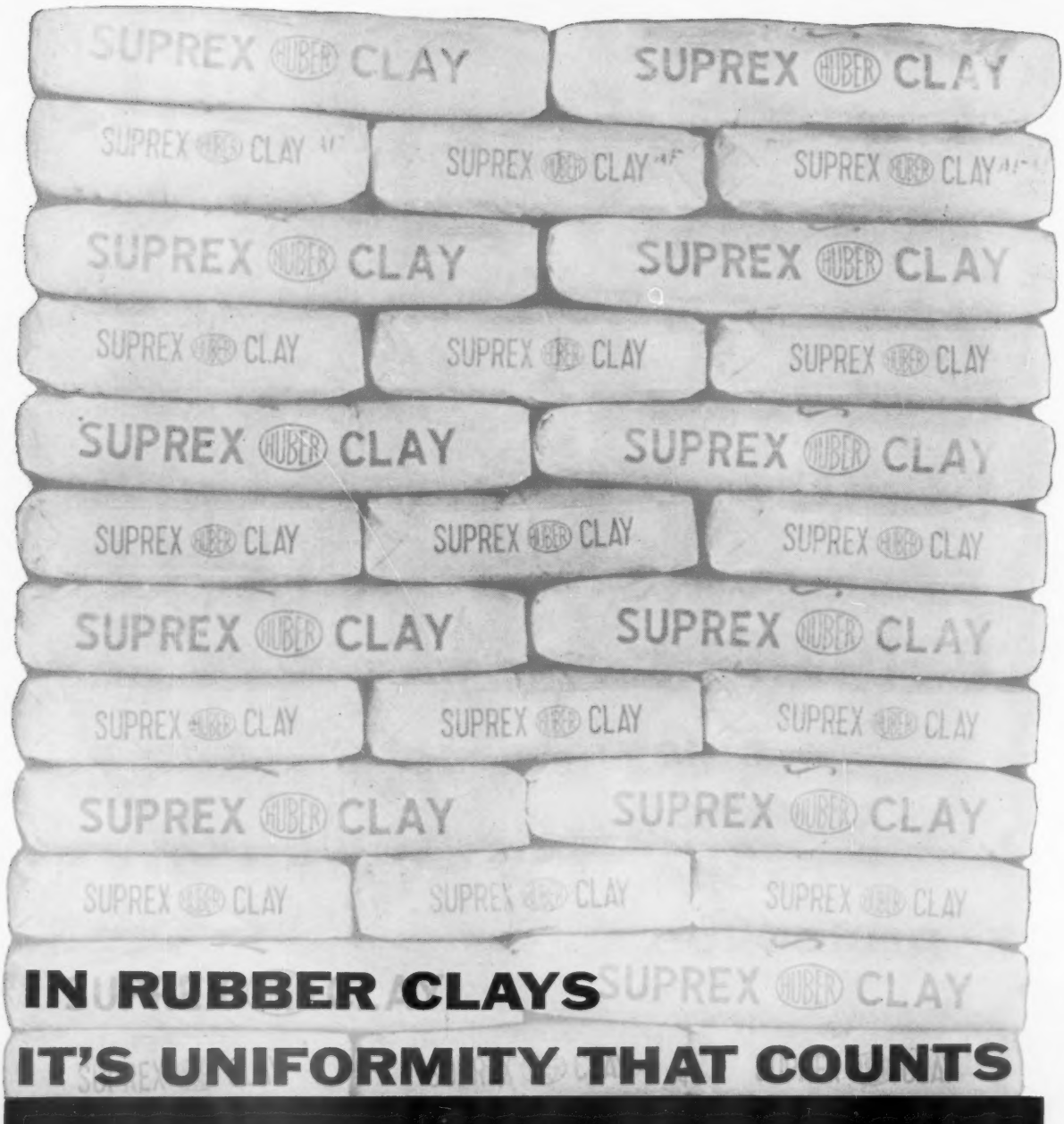

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Rubber Age

COVERING THE MANUFACTURE OF RUBBER AND RUBBERLIKE PLASTICS PRODUCTS

NOVEMBER, 1957 VOL. 82 NO. 2

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In This Issue

275 **A Comparison of Instruments Used to Determine the Suitability of Elastomers for Low Temperature Service. Part II: Stress Decay**—By M. Hanok, J. Z. Lichtman, C. K. Chatten and G. Adler

Results of a study made to evaluate the performance of six different instruments in determining the stress decay of elastomers at low temperatures.

286 **Recent Developments in Compounding Kel-F Elastomers**—By Lester E. Robb and Francis J. Honn

Report on a practical polyamine cure utilizing HMDA-Carbamate and use of a high melting fluorocarbon wax as a processing aid.

291 **Function of Rosins and Rosin Derivatives in Pressure-Sensitive Adhesives**—By Frank H. Wetzel

An investigation of tack as a function of concentration of various rosin-based tackifiers in natural rubber.

296 **A Uni-Rotor Mixer for Rubber and Plastics**—By W. F. Watson and D. Wilson

Description of a machine based on a new concept of the mixing operation.

Special Reports

Capitol Cues	223	300	News Highlights
Markets	356	332	Overseas

Regular Departments

Book Reviews	352	320	Names in the News
Canadian News	322	346	New Equipment
Chemical Prices	*	336	New Goods
Classified Ads	371	330	Obituaries
Coming Events	319	230	Patent Review
Editorials	299	360	Statistics
Financial News	324	328	West Coast News
Letters to Editor	206		

*Appears every other month

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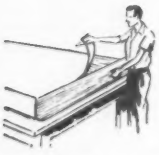

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Letters to the editor

Nomenclature Comments

Dear Sir:

You are to be congratulated on the editorial entitled "Nomenclature: Is it hitting the mark?" in the October, 1957, RUBBER AGE. The question you raise, concerning the attempt being made by ASTM to saddle the rubber industry with an impossible combination of confusing letter combinations for the various rubbers, is long overdue. We agree with you that the ASTM tentative recommendation D-1418-56T should be withdrawn at once, and suggest that the entire subject be reconsidered by the Rubber Division.

In my opinion a matter of this kind, which primarily concerns rubber people, should be handled *first* through an established rubber group such as the Rubber Division of ACS. Then, when the rubber men themselves have agreed on a nomenclature system, ASTM could function to put it into general use.

There is one other point I would like to make concerning the nomenclature problem. A number of people, including yourselves, seem to worry about the continued use of the term GR-S. Personally I see no reason for attempting to abandon the use of a name which for the past 12 years has become familiar to and accepted by everyone all over the world. It is not important that the letters no longer mean "Government Rubber". What is important is that the term describes to all users a very definite material, and to attempt to wipe out the name at this late date would only lead to endless confusion in the literature and in everyday usage.

K. J. SOULE

Manhattan Rubber Div.,
Raybestos-Manhattan, Inc.,
Passaic, N. J.

Dear Sir:

I have read with great interest your editorial in the October, 1957, issue of RUBBER AGE asking the very pertinent question as to whether the ASTM recommended nomenclature practice is actually serving any useful purpose. I agree wholeheartedly that these designations are not necessary and that they result in confusion rather than simplification.

Each of the synthetic rubber producers spends considerable amounts of money to associate his particular products with a brand name. I feel certain that with the passage of time minor modifications of the products will occur so that it will be more difficult to associate a given product with a broad general classification.

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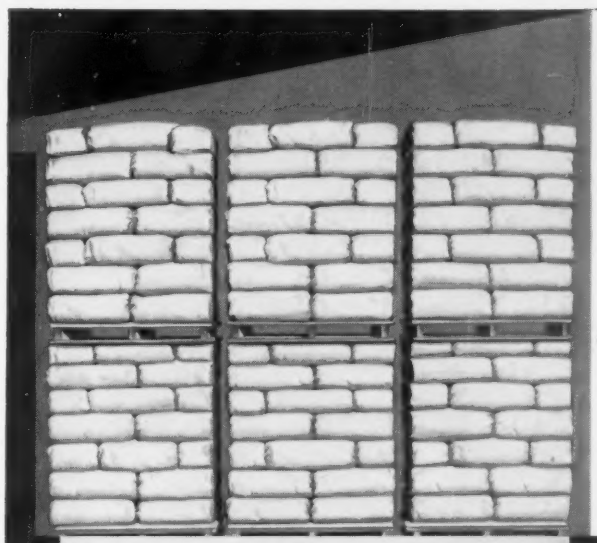

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want to sell IIR grade 218 any more than any other producer of synthetic rubber would want to sell, for example, SBR grade 1500. I believe strongly that the code system suggested be eliminated at once.

J. P. HAWORTH

Enjay Co., Inc.,
15 West 51st St.,
New York 19, N. Y.

Dear Sir:

I am in accord with the objections to the new nomenclature discussed in your editorial of the October, 1957, issue. The approach is academic and would create confusion instead of simplification.

I must take exceptions to some of the statements made in the same issue by William P. Welch in his article on non-woven fabrics. As was brought out in the Boston Federal Court in 1926 in the patent infringement suit Respro vs. Sydeman, rubber bonded non-woven fabrics were old art even then. Respro, now a part of General Tire, and Stedfast Rubber Co., were making such fabrics then for the shoe and electric industries.

MORRIS OMANSKY

238 Main St.,
Cambridge 42, Mass.

Dear Sir:

I enjoyed reading your editorial on "Nomenclature: Is It Hitting the Mark?" I think you have hit the right slant.

I especially liked the following:

"We see absolutely no objection to spelling out these specialty polymers with their full chemical names. Thus, there can be no confusion as to the exact polymer under discussion."

"It is very difficult to get industry to adopt new terms."

"It is time to call a halt before complete confusion besets the literature."

GR-S Type could well be used to cover all these polymers, at least for some time, even though each company has its own name.

HARRY L. FISHER

4116 Santo Tomas Drive
Los Angeles 8, Calif.

Dear Sir:

At long last I am catching up with some of my reading and in some instances I am really up-to-date.

In going over the October issue of RUBBER AGE, I came across your editorial on nomenclature. Let me congratulate you on an excellent job. I sincerely concur with your suggestion to call a halt before complete confusion reigns.

I really hope you get an active response on this editorial and gather the needed support to rectify this horrible situation on nomenclature.

EDWARD V. OSBERG

National Polychemicals, Inc.
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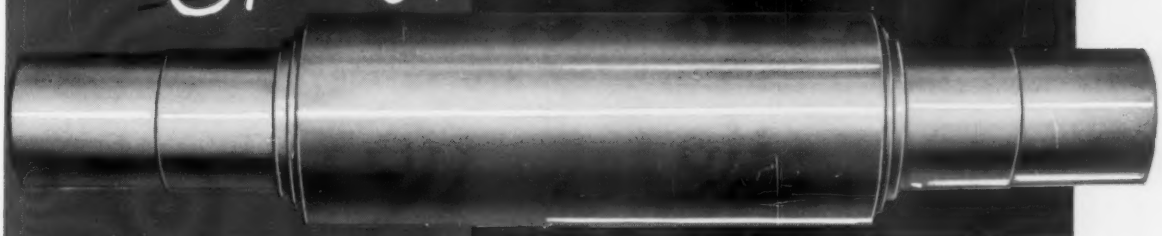

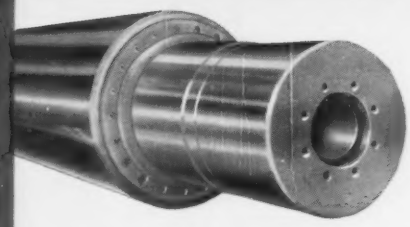

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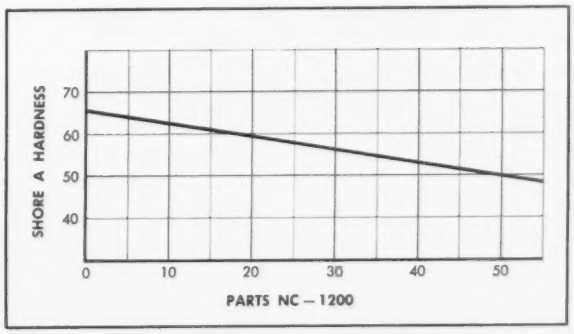

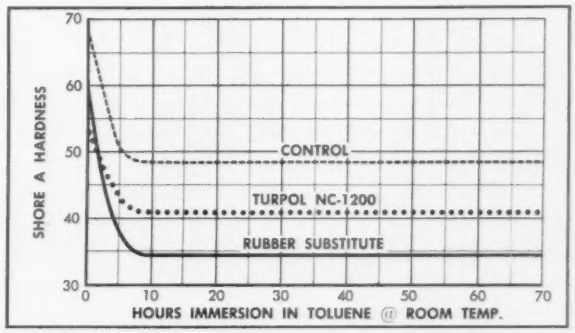

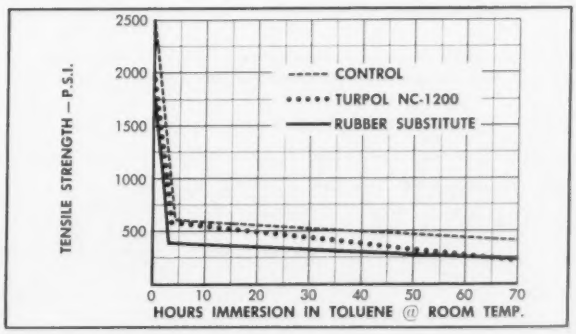

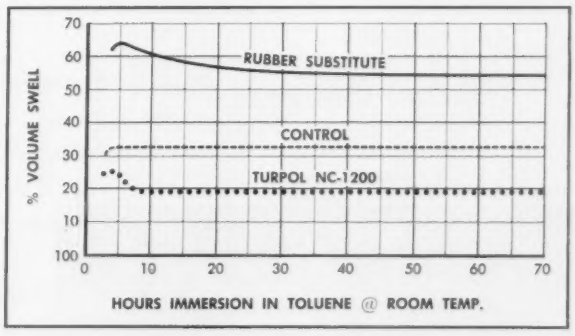

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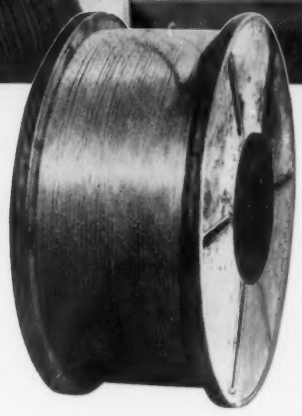

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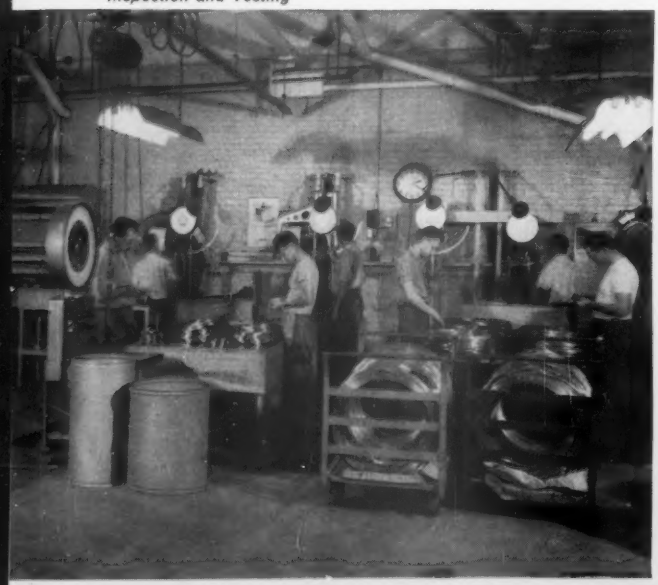
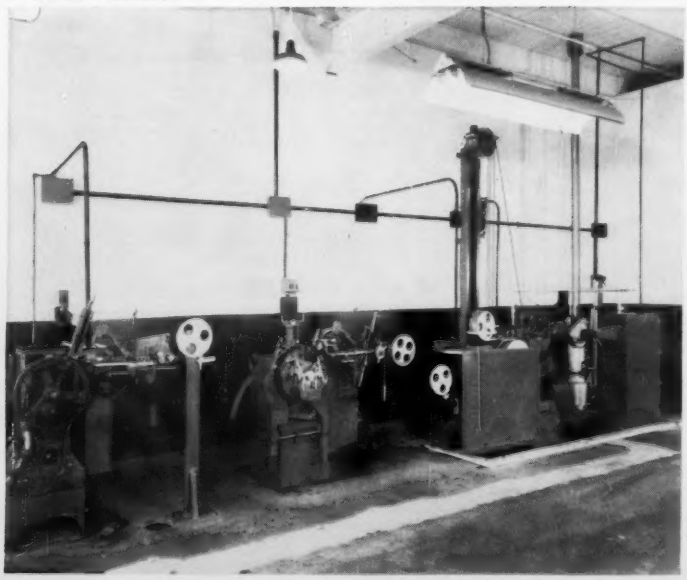
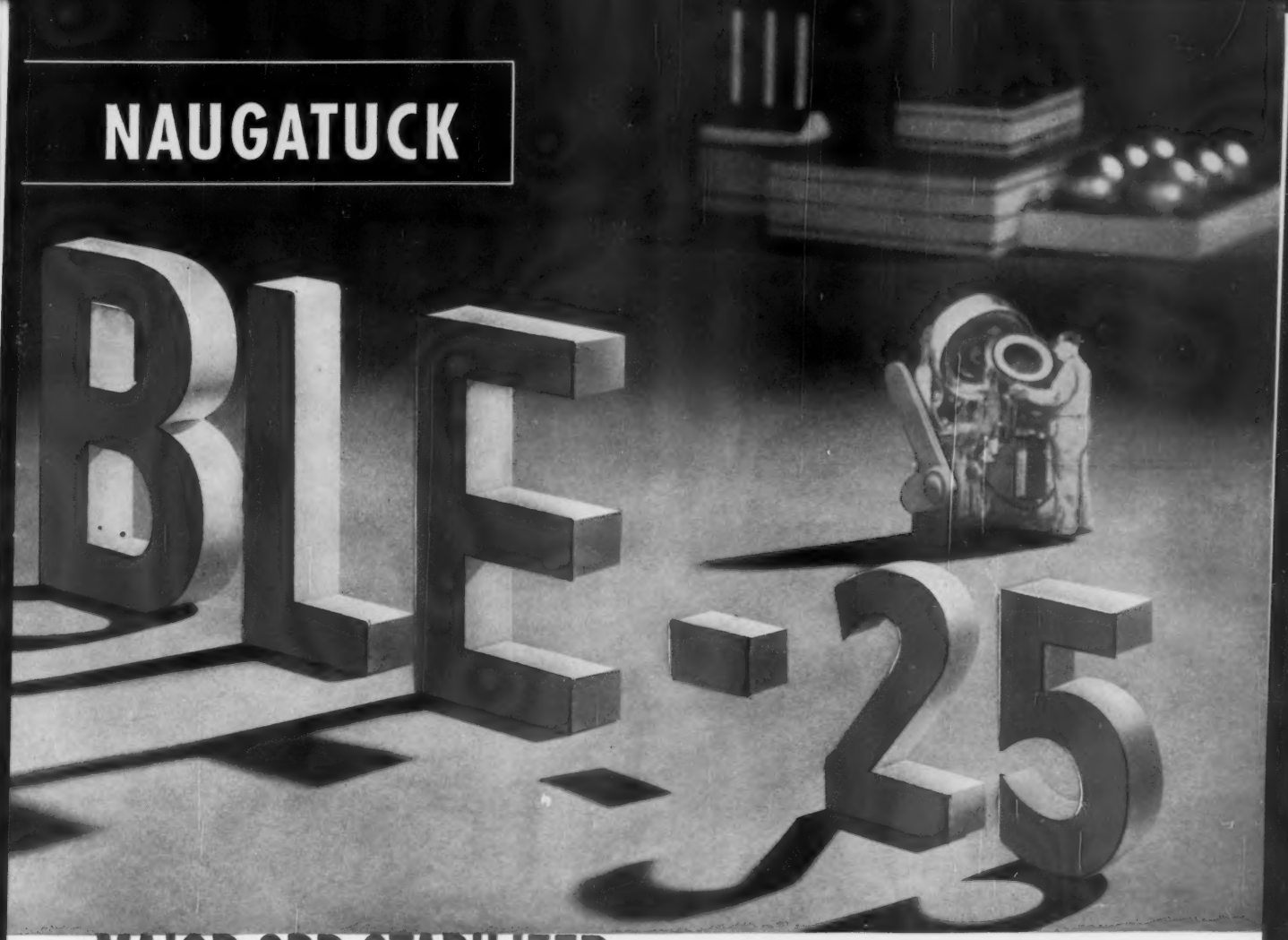
Inspection and Testing



Tire Bead Production



NAUGATUCK



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Hydraulic Press Division

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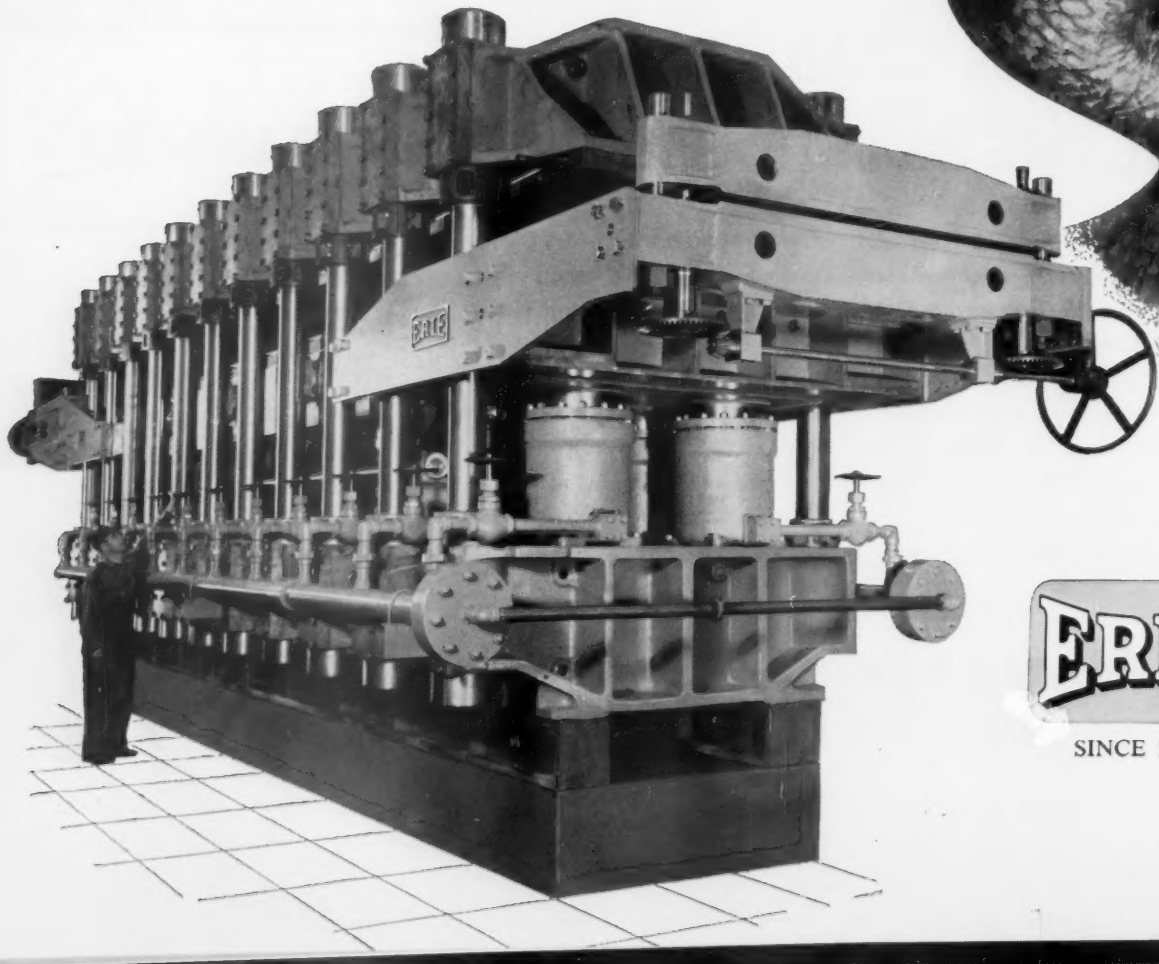

ERIE

SINCE 1895

Photo courtesy Cameron Iron Works, Inc., Houston, Texas, and Linear, Inc., Philadelphia, Pa.–Manufacturers of Precision Molded Seals

How to make 4 lbs. of rubber pack a 1000-ton load

To batter a billet into rough shape, prior to machining, is no chore for the hydraulic forging press shown above. A press of a button and it works down the hot steel with a thousand tons of pressure every several seconds.

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Photo Courtesy Seatrain Lines Inc., New York, N. Y.

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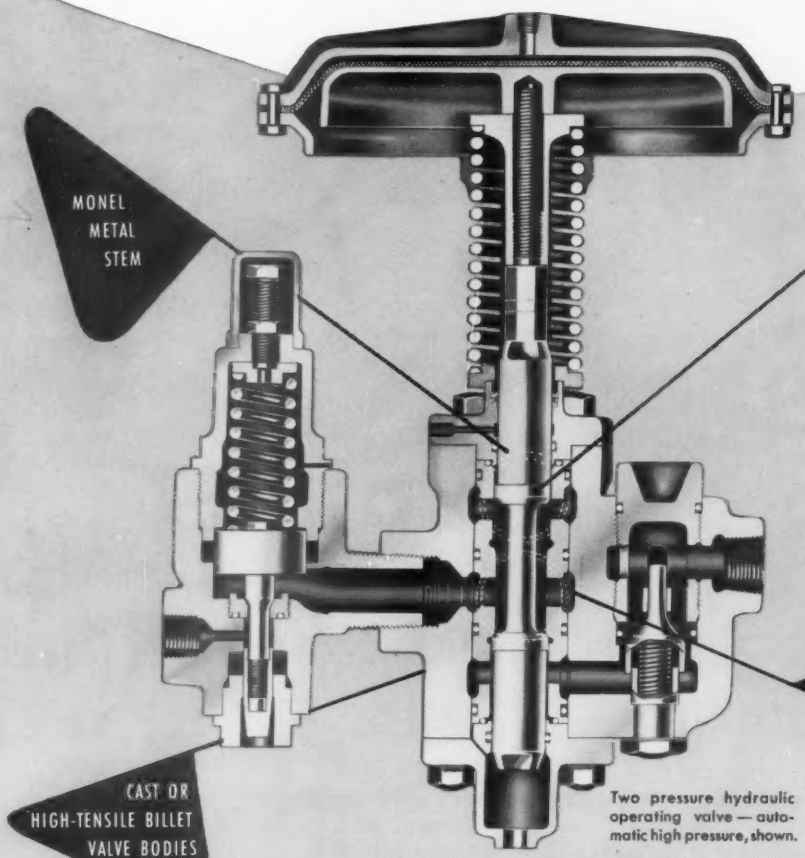
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Capitol Cues

BUSINESS IN THE SECOND HALF OF 1957 will post some real gains over the first six months. That seems to be the consensus of most economists in industry and government—including those officials who advise the President. The plateau of recent months will turn into a modest uptrend. This doesn't mean a resumption of the recent boom. But the increases will certainly be enough to establish 1957 as the biggest year in all the country's history.

The pattern foreseen is very much like last year's when things also started slow, then finished in a rush. In '56, the third quarter dragged, partly because of the big steel strike; this Summer will be slow, too, with things moving along side-wise. The last quarter will see quite a bit of rise, as was the case in '56: Total output will climb at a $10 billion a year rate.

The upward push will come from several sources:

- Government spending...state and local, as well as federal... is rising steadily—for defense and long overdue public works.
- Inventory-buying by business will mean a lift, too. Industry held its purchasing down in the first half, though there was no drop in goods consumption. So stocks fell in many lines. Now, stocks must be rebuilt for Fall and Christmas business.
- Factory building by industry will set new records. Gains may not be as large as in recent periods, but will still add lift.

ADDITIONAL REASONS FOR OPTIMISM lie in the fact that the soft spots that slowed business during the first half are now showing signs of firming. The signs are still faint, but they are definitely considered encouraging. Take housing, for example—a big stimulator for many supplying industries. The recent hike in FHA interest rates allowed has already lured more money into housing and spurred building. And Congress has voted still more funds.

New car sales—another soft spot—are slated to perk up, too, as a result of big Summer sales pushes and the snappy new GM models due out in the Fall. House-furnishings will do better on good air conditioner sales this Summer, good TV business in the Fall. Many families will have cleared up instalment debt.

MONEY WILL GET TIGHTER DURING THE SECOND HALF. Demand for credit will go up faster than supply. Industry must finance Fall inventory; the Treasury must raise $3 billion more than in July-December of 1956; and the state and local governments must borrow a lot to pay for the public works.

If all demands are met...and officials could meet them just by creating the credit...there'd be a big new surge of inflation. To prevent this, they'll hold the extra credit made available to what experts consider "normal or legitimate" rises in demand. This means that getting greater-than-usual credit may be tough. Even so, it looks as if interest rates may be forced up a notch.

NO SOLUTION TO THE TIGHT-MONEY PROBLEM seems likely to emerge from the hearings held by the Senate Finance Committee. The tone of questions and answers during the quizzing of key government officials shows that the main result may be political ammunition for the Democrats for the campaign in '58. No one present seemed ready for a serious approach to the matter.

Continued on Next Page

THE EXPLANATION OF TODAY'S PUZZLING INFLATION, as economists see it, is this: Normally, prices rise when goods are short or when government lives beyond its income and prints the money to pay for what it buys; but this is not the case today. Instead, labor is strong enough to force wage hikes, regardless of productivity or living costs. And business passes them along in higher prices rather than force labor strife. Government price supports aggravate the situation. And, finally, there's not enough savings coming along to meet all the government and business demand for long-term money.

It's hard to say just when the inflation may end. Most experts think only a severe cut in available credit will stop the rise. That could start a recession, which the government won't risk.

A NEW SOURCE OF LONG-TERM CAPITAL for small business is under study these days by influential Senators. It's a proposal for establishing capital banks under federal charter. The lawmakers realize that small concerns can not raise money by floating securities as readily as big outfits do and that undercapitalization is often the main reason that small businesses go broke.

The banks would lend large sums for long periods at favorable rates of interest. These banks could also buy common stocks. There will be difficulties in putting the scheme over—getting investors to put up the starting capital. But sponsors think they have that licked and hope to vote a law at next session.

The idea isn't new, but the current proposal—introduced by Senator Sparkman—would have plenty of federal help. First, there'd be a tax advantage to investors, some of the initial profits being tax-free. Equally important, a government agency would start the banks but sell out to investors once launched.

WHAT IMPACT WILL DISARMAMENT HAVE on business in this country, if an understanding is reached with Russia? Not very much, say officials who are following the negotiations at this end. No big cuts in government arms orders seem likely. Therefore, the indirect effect on non-defense business will be slight, too. The nervousness some businessmen felt—as shown by the stock market—stemmed largely from lack of understanding of what's involved.

The main U.S. goal is NOT a quick, sharp cut in arms, though that would be desirable. Both sides are groping for a more limited objective—some way of halting the arms race. A first step would have to be development of mutual confidence as to each side's sincerity. Then, both camps might feel free to disarm.

The key proposals under discussion involve few dollar cuts:

- Suspension of bomb tests would involve only a little manpower and materials. Production of today's bombs would continue.
- Halting bomb output would cut the Atomic Energy Commission's operations by less than $1 billion—mostly at the AEC plants.
- Cutting troop numbers to 2½ million men might save $1 billion a year in pay, allowances, and upkeep, plus another $1 billion in post maintenance. Cuts to 1.7 million men are years away.

The biggest foreseeable cut would be less than what followed truce in Korea, which business absorbed with little trouble.

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- ☐ Application Data Sheet 41156—Flexible Foams
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- ☐ Application Data Sheet 112356—Protective Coatings
- ☐ Interested in literature only
- ☐ Have representative call by appointment

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Ameripol... HOT POLYMERS

Types	Physical Properties*		Selection Guide
1000	Tensile	3030 psi.	General purpose rubber for products where color unimportant. Used for tires, molded and extruded products.
	Elongation	600 %	
	Modulus @ 300% Elongation	980 psi.	
	Mooney Viscosity—		
	ML212°F. @ 4 minutes		
	Raw Polymer	48	
	Compounded Stock	55	
1001	Tensile	3030 psi.	Similar to 1000, but less staining and discoloring. For tires, shoe soles and heels, molded and extruded products.
	Elongation	600 %	
	Modulus @ 300% Elongation	1010 psi.	
	Mooney Viscosity—		
	ML212°F. @ 4 minutes		
	Raw Polymer	47	
	Compounded Stock	55	
1002	Tensile	3000 psi.	Rosin acid soap provides more processing tack and lower modulus than 1000 and 1001. For tires, molded and extruded products.
	Elongation	650 %	
	Modulus @ 300% Elongation	950 psi.	
	Mooney Viscosity—		
	ML212°F. @ 4 minutes		
	Raw Polymer	53	
	Compounded Stock	55	
1006	Tensile	2850 psi.	An improved, lighter colored rubber, relatively non-discoloring and non-staining. For white and pastel colored products—tile, toys, side walls, etc.
	Elongation	590 %	
	Modulus @ 300% Elongation	1010 psi.	
	Mooney Viscosity—		
	ML212°F. @ 4 minutes		
	Raw Polymer	50	
	Compounded Stock	58	
1007	Tensile	2760 psi.	Relatively low water absorption, improved electrical properties. For insulation and electrical products, gaskets, etc.
	Elongation	620 %	
	Modulus @ 300% Elongation	890 psi.	
	Mooney Viscosity—		
	ML212° @ 4 minutes		
	Raw Polymer	48	
	Compounded Stock	54	
1009	Tensile	1850 psi.	A cross-linked polymer used with other polymers to reduce shrinkage and die swell in calendering and extrusion. For footwear, insulation, calendered goods.
	Elongation	360 %	
	Modulus @ 300% Elongation	770 psi.	
	Mooney Viscosity—		
	ML212°F. @ 4 minutes		
	Compounded Stock	126	

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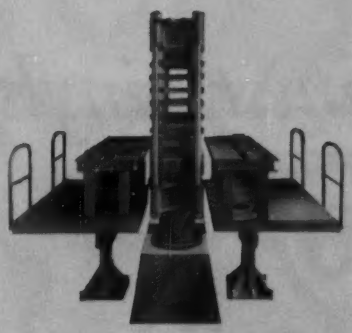

192-ton Multiple Opening Platen Press. Designed for molding rubber products. This press may be operated from an individual self-contained pumping unit or a central accumulator system. Two elevators operate with two presses working side by side. Write for catalog and engineering information on this and other R. D. Wood Hydraulic Presses for the rubber industry—without obligation.

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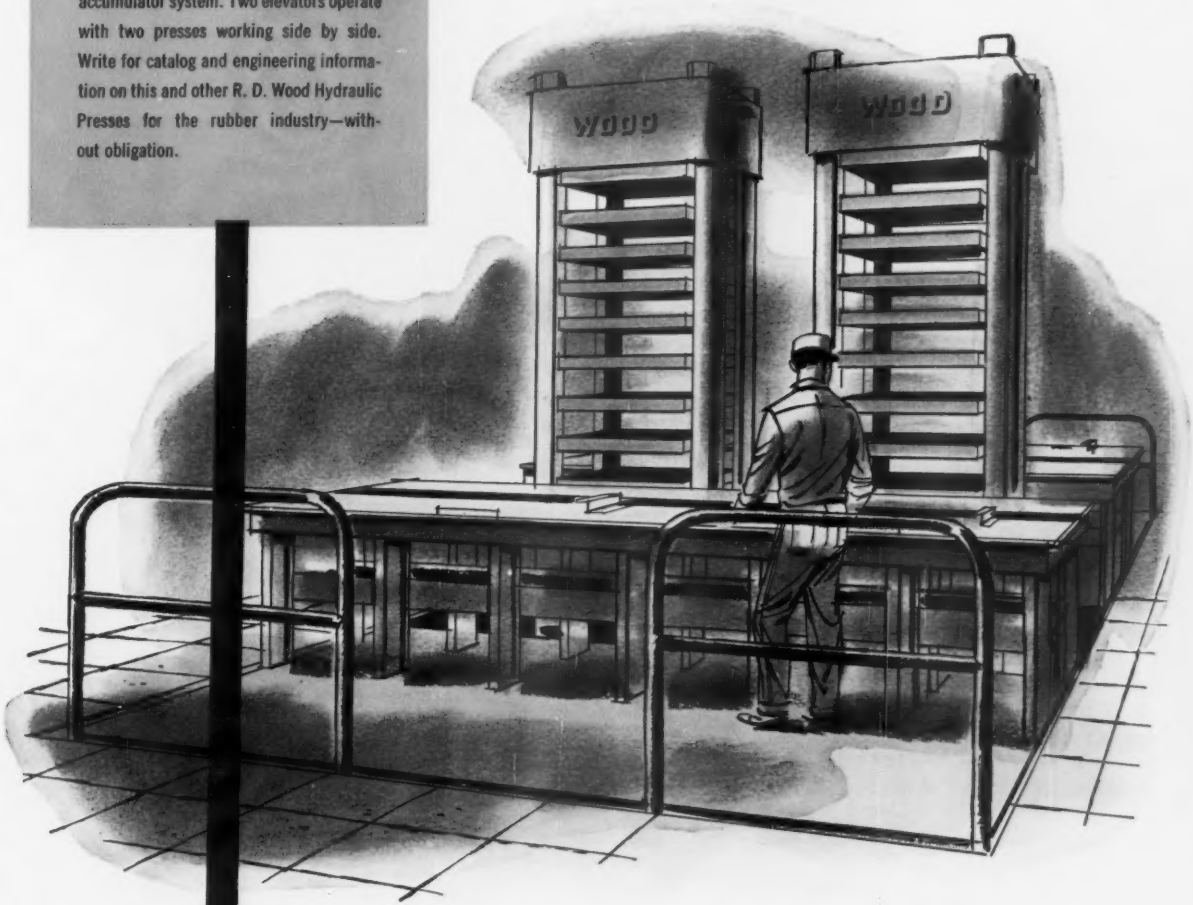

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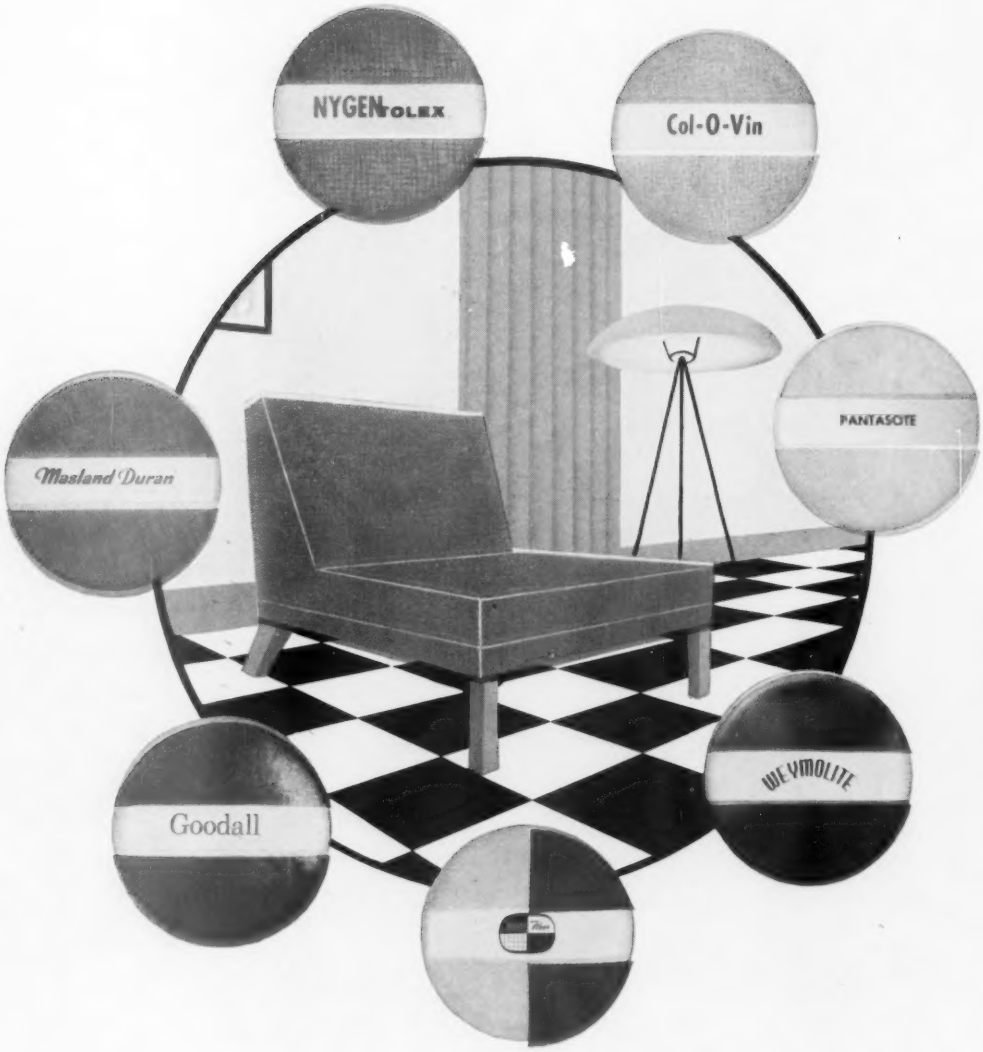

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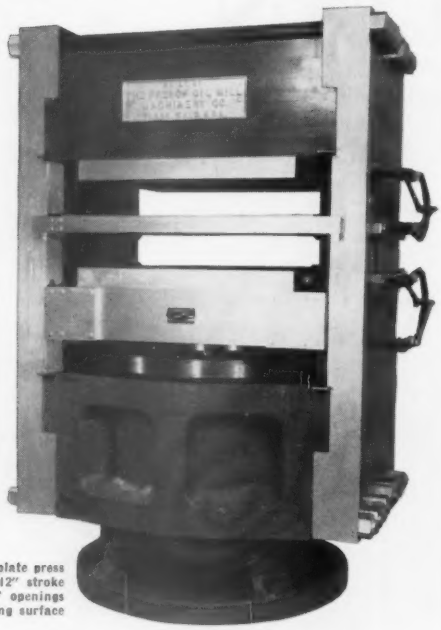

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PATENT REVIEW

by Melvin Nord

Rubber Antioxidants

U.S. 2,789,102, issued April 16, 1957 to Elliot L. Weinberg, assigned to Metal & Thermit Corp., discloses a new type of antioxidant for natural and synthetic rubbers. The compounds used are organotin derivatives having the general formula

$$R_n S_n [SR' (COOR'')_x]_{4-n}$$

where n = 1,2, or 3; x = 1 or 2; R is alkyl, aralkyl or aryl; R′ is an aliphatic or aromatic hydrocarbon radical of valence x + 1; and R″ is hydrogen, alkyl, aralkyl, or aryl. In U. S. 2,789,103-7 the same inventor discloses additional organotin compounds, serving a similar purpose.

U. S. 2,789,108, issued April 16, 1957 to Gordon S. Mills and Henry W. H. Robinson, assigned to Monsanto Chemicals Ltd., discloses the fact that an effective antioxidant action can be obtained by using as an antioxidant in vulcanized rubber a mixture of a 2:4:6-trialkylphenol and a mono-ether of a dihydric phenol. Mixtures of this kind are suitable for use in light-colored stocks.

Low Hysteresis Rubber Treatment

U. S. 2,790,839, issued April 30, 1957 to Kenneth W. Doak, assigned to United States Rubber Co., provides a new promoter for the low hysteresis processing of rubber and carbon black mixtures at relatively high temperatures. It has been found that piperidinium pentamethylene dithiocarbamate decreases the time and/or lowers the temperature necessary for such low-hysteresis processing.

In U. S. 2,791,572, issued May 7, 1957, the same inventor discloses the use of aromatic sulfonyl chlorides as a promoter for low hysteresis rubber processing.

Aqueous Emulsion Polymerization

U. S. 2,787,604, issued April 2, 1957 to James R. Miller and assigned to The B. F. Goodrich Co., describes a process for the manufacture of a stable synthetic polymer latex having affinity for fibrous materials such as textiles and paper and having any desired pH within the range of 1.5 to 11.5, by the polymerization in aqueous emulsion of a monomeric material consisting of 75 to 90% vinylidene chloride, 5 to 15% vinyl chloride, and 5 to 15% of an alkyl acrylate.

The aqueous emulsion of the monomeric material is formed with the emulsifying agent N-dodecyl-beta-alanine. To the emulsion is added a sufficient quantity of a neutralizing agent (hydrochloric acid or an alkali

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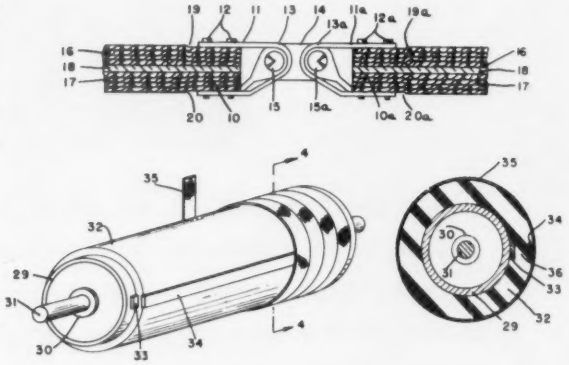
hydroxide) to neutralize the N-dodecyl-beta-alanine and form its salt and to produce the desired pH. The emulsion is then agitated in the presence of a polymerization catalyst at -10° to 80°C. to effect conversion of the monomeric material to polymer, and thus produce a stable latex.

New Design for Connector-Type Belt

U.S. 2,796,911, issued June 25, 1957 to Dale L. Waugh and assigned to Dayton Rubber Co., relates to connector type or non-endless belts. The object is to minimize the difference between the ultimate tensile strength of the belt proper and the connector pull-out strength. This is accomplished by increasing the density of the portions of the belt to be received by and anchored to the connectors.



At the top of the accompanying illustration there is shown a connector-type belt having connector ends 10 and 10a fastened to connector straps 11 and 11a by rivets 12 and 12a. The straps are themselves connected at the loops 13 and 13a by a linkage 14. The belt itself is composed of a tension section 16 of superimposed layers of rubberized fabrics, a neutral axis section 18 consisting of one or more layers of helically wound cord, and a compression section 17 of superimposed layers of rubberized fabric.

It is to be noted that at 19, 19a, 20, and 20a, the upper and lower surfaces of the belt are indented so as to form the neck portions to be held within the straps 11 and 11a. These neck portions contain the same amount of belt material per unit length, but, having been compressed, are of increased density.

The diagrams at the bottom of the illustration show the method of constructing the connector belt. A belt mandrel or drum 29 is shown mounted at bearing 30 on the rotatable shaft 31. A belt sleeve 32 is built about the mandrel 29. The compression strips 33 and 34 are axially aligned along the surfaces of the belt sleeve 32 as shown. The compression strips so engage the belt sleeve that upon the application of the compacting means such as the rag wrapper 35 the material of the belt sleeve

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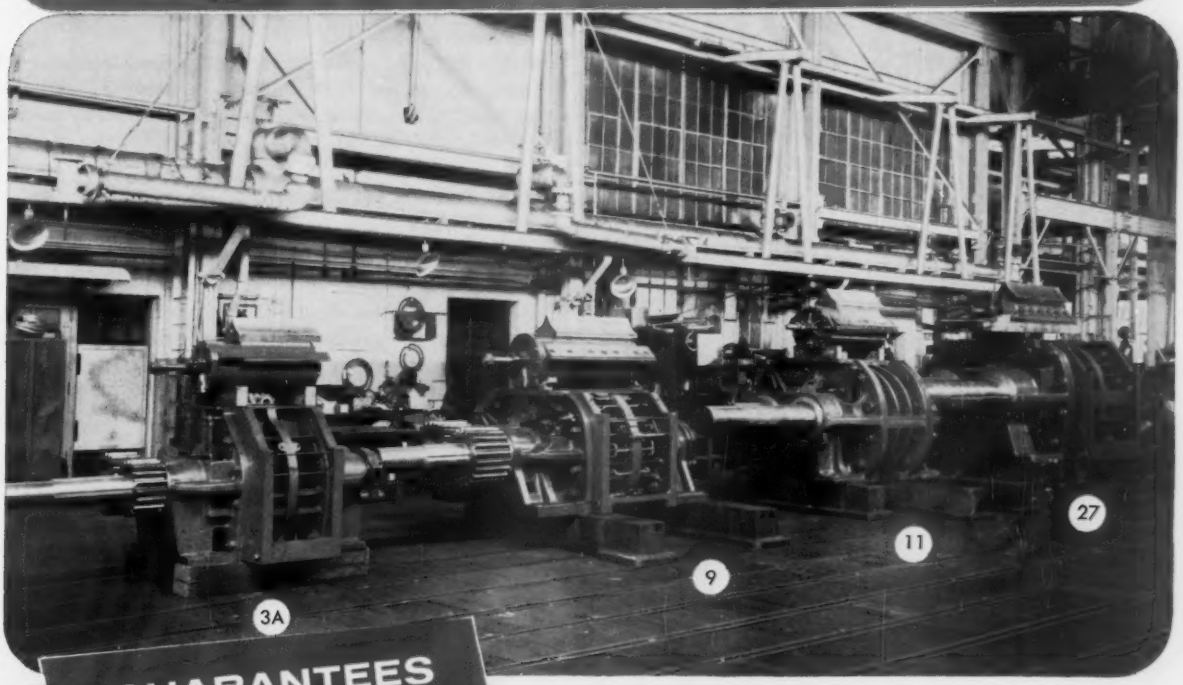

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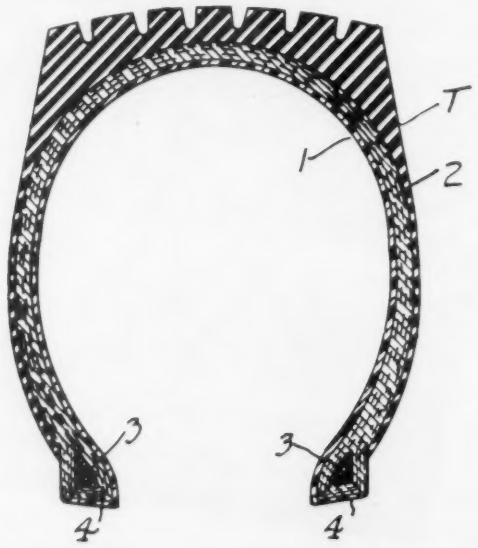
will be compressed, as shown at 36 on the right. The sleeve, thus compacted and further compressed and while still on the mandrel 29, is subjected to vulcanizing heat so as to integrate the components of the belt sleeve and to fix the state of increased density and reduced thickness of the portion 36.

After this vulcanization, the compacting medium 35 is removed, as are the compression strips 33 and 34, after which individual annular belts are formed by cutting the sleeve circumferentially.

Improved Pneumatic Tire Carcass

U.S. 2,795,262, issued June 11, 1957 to Paul A. Frank, describes an improved method for producing pneumatic tire carcasses.

As shown in the diagram, the invention consists of forming a cured pneumatic tire casing, T, by applying to the inner surface of the green tire a film, 1, of a silicone compound which makes unnecessary the use of an inflatable diaphragm when the tire is cured.



The green tire carcass is constructed from cord fabric, 2. This fabric is formed of a series of closely adjacent parallel cords of natural or synthetic fibers, the cords being impregnated with and cemented together by means of natural or synthetic rubber. Because this fabric is not impervious to air, steam, or hot water under pressure, and since there are seams between the ends of each ply and between adjacent plies, some means must be provided to prevent the fluid under pressure, which is utilized to shape the tire and to expand and heat it during the curing operation, from seeping into the body of the tire carcass. This is accomplished in the present invention by means of a thin film, 1, of silicone polymer, instead of by the use of a tube or bag.

The silicone may be one of a number of silicone rub-

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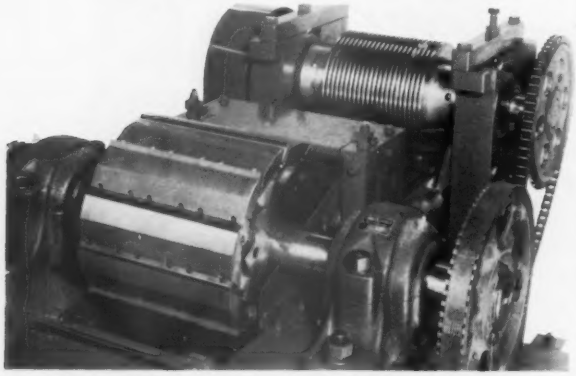

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bers known as Silastics which are made by Dow-Corning Corp. Since the silicone material requires a longer time for curing than the organic rubber of the body of the tire, it may be desirable to partially pre-cure the film before the pulley band carcass is subjected to preliminary formation.

Method of Making Tubeless Tires

U. S. 2,788,839, issued April 16, 1957 to Robert W. Kindle and John J. Fleming, assigned to United States Rubber Co., discloses a new composition for the inner layer or liner of tubeless tires. The invention is based on the discovery that if butyl rubber to be used in the liner is first modified by reacting it, under critical conditions, with critical, small amounts of certain phenolic resins of the resol type, the butyl rubber is converted to a condition in which it is readily compatible with natural or styrene rubber, yielding a blend that is capable of developing good physical properties upon vulcanization and that adheres unusually well to the usual tire carcass materials.

Other Patents Of Interest

Subject	Inventor or Assignee	Patent No.	Date
Method for curing friction materials for use as automotive brakes	Raybestos-Manhattan, Inc.	2,790,206	4/30/57
Secondary closures for bottles	Goodyear Tire & Rubber Co.	2,790,285-6	4/30/57
Apparatus for placing bead cores on tire building drums	Firma Continental Gummi-Werke	2,790,481	4/30/57
Rubber stabilized with hydrocarbon tin mercapto alcohol esters	Metal & Thermit Corp.	2,790,785	4/30/57
Packaging tacky styrene rubber in a film of compatible styrene-isobutylene copolymer	Esso Research & Engineering Co.	2,791,326-7	5/7/57
Apparatus for producing foam rubber	Mildred M. Kelly	2,791,404	5/7/57
Article coated with terpolymer of butadiene, acrylonitrile, and methacrylic acid	United States Rubber Co.	2,791,519-20	5/7/57

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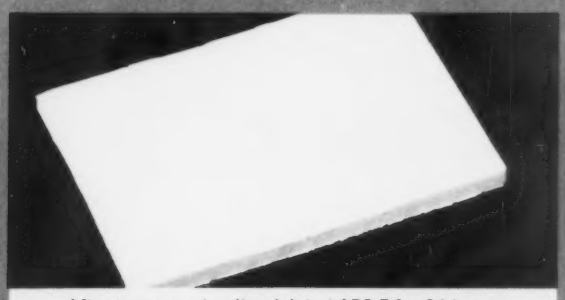
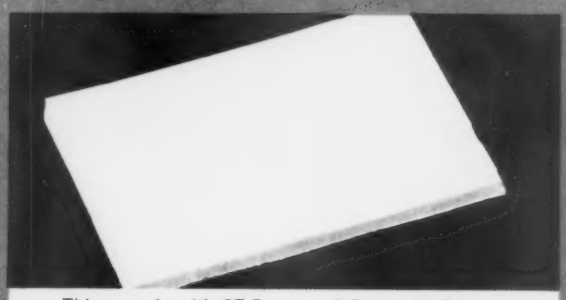


After exposure to ultraviolet at 150 F for 24 hours, this oil-free vulcanizate shows very little stain.



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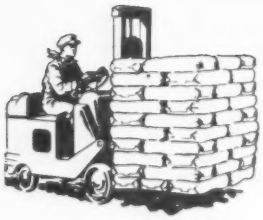

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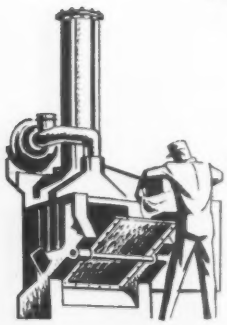

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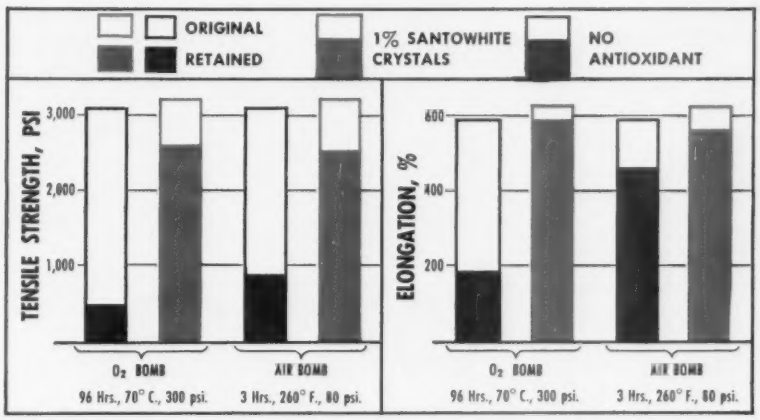


Results of air bomb and oxygen bomb tests show how effectively Santowhite Crystals protect the original properties of a natural rubber stock.

SANTOWHITE "Crystals" was the first *thio* bisphenol-type antioxidant . . . and it offers some important benefits to draw upon in the complicated business of devising compounds that work.

Most important, of course, is that SANTOWHITE Crystals can be used in white or light-colored stocks based on both natural and on most synthetic rubbers; it does not "dye" the compound. Next, this hindered phenol is nonstaining to lacquered and enameled surfaces that must contact the finished rubber part . . . so it has its place, too, in dark-colored compounds where heat and oxidation resistance are needed but staining danger cannot be risked.

Although each rubber formulation performs differently, here is what you can obtain by adding 1 part per hundred parts of rubber: markedly less loss of tensile strength and elongation from heat exposure; improved retention of resilience over the service life of the compound; retarded stress decay.

SANTOWHITE Crystals is essentially 4,4′-thiobis-(3-methyl-6-tert.-butylphenol). Chemically stable, it does not react with other conventional compounding ingredients, does not activate or retard the cure, gives positive protection.

If you want heat-oxidation resistance in a latex, for example, you'll find that SANTOWHITE Crystals give the cured compound the best protection available where discoloration and staining cannot be tolerated. In foam, rug backing and dipped goods, SANTOWHITE provides good protection against "aging" degradation. In fact, this antioxidant, in most applications, is perhaps the most powerful oxidation protectant of the nonstaining, non-discoloring type in industry.

Whenever you need a nonstaining, non-discoloring antioxidant, try SANTOWHITE Crystals in the range of 1-2% on the rubber. Monsanto's compounding specialists will be happy to work with you on your specific formulation.

Accelerators
—For fast, slow and regulated rates of safe cure.

Antioxidants
—For positive protection against oxidation degradation.

Plasticizers

Specialty Processing Compounds

Santowhite—T.M. Monsanto Chemical Company

For further information, write us or call:
MONSANTO CHEMICAL COMPANY
Rubber Chemicals Department
Akron 11, Ohio Telephone: HEmlock 4-1921
In Canada: Monsanto Canada Ltd., Montreal

Monsanto®

Lucky it's ...

GEN—TAC®!

. . . FREEZING WON'T RUIN THIS CARGO!

That's right! Even when frozen and thawed, Gen-Tac's outstanding quality remains unaffected. When subjected to freezing temperature for hours at a time, Gen-Tac won't break down. Gen-Tac, General's proven vinyl pyridine latex, has excellent freeze stability, and assures the best fabric-to-rubber adhesion in tires and other applications. Write for literature and samples to The General Tire & Rubber Company, Chemical Division, Akron, Ohio.

Moisture degradation — Gen-Tac keeps this from happening to your tires. Cord treated with Gen-Tac adheres to rubber so well that moisture doesn't "wick" in to loosen the cords.

Curing blows—Gen-Tac cuts curing blows like this to a minimum because it is fast-curing and develops its strength in the early stages of cure when internal pressures do the most harm.

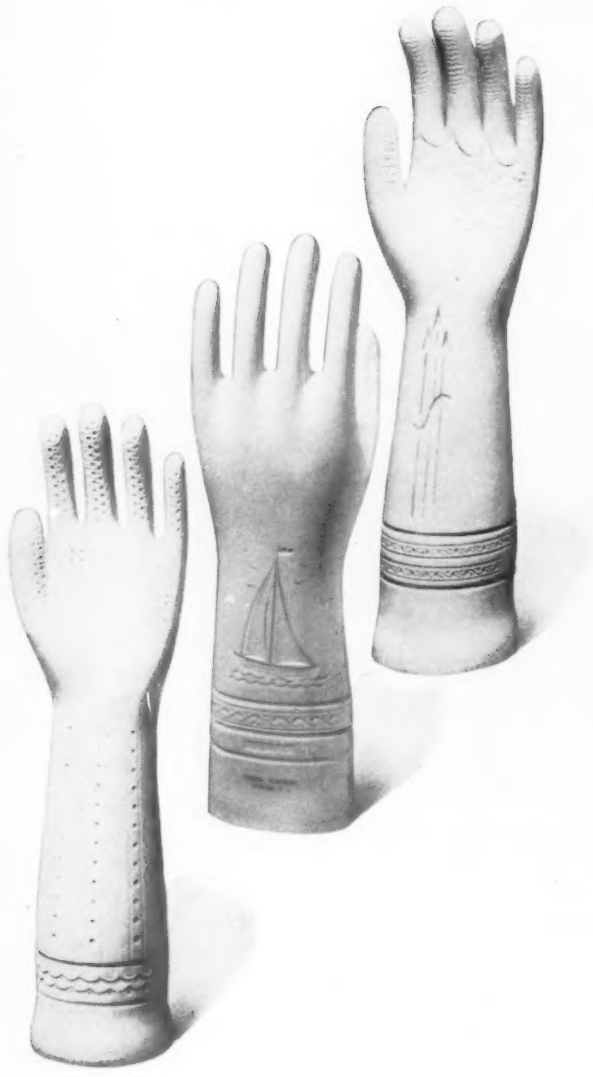
Adhesion—Gen-Tac treatment of tire fabric provides adhesion-to-rubber strength greater than the strength of the surrounding stock itself.

THE GENERAL TIRE & RUBBER COMPANY
Chemical Division
AKRON, OHIO

Chemical Division GENERAL THE GENERAL TIRE & RUBBER CO. GEN-TAC®

Creating Progress Through Chemistry

HIGH LIFE porcelain forms . . .



FOR LADIES' HOUSEHOLD GLOVES

Here's how to add **sales appeal** to your rubber gloves—use General Porcelain well fabricated porcelain forms, with attractive designs as shown here. These forms are certain to give you long satisfactory service because they are free from pits or defects and are fired to the closest plus or minus ranges. Only perfect forms can pass our rigid inspection. You profit from the fact that the principals in this company are practical men with years of experience.

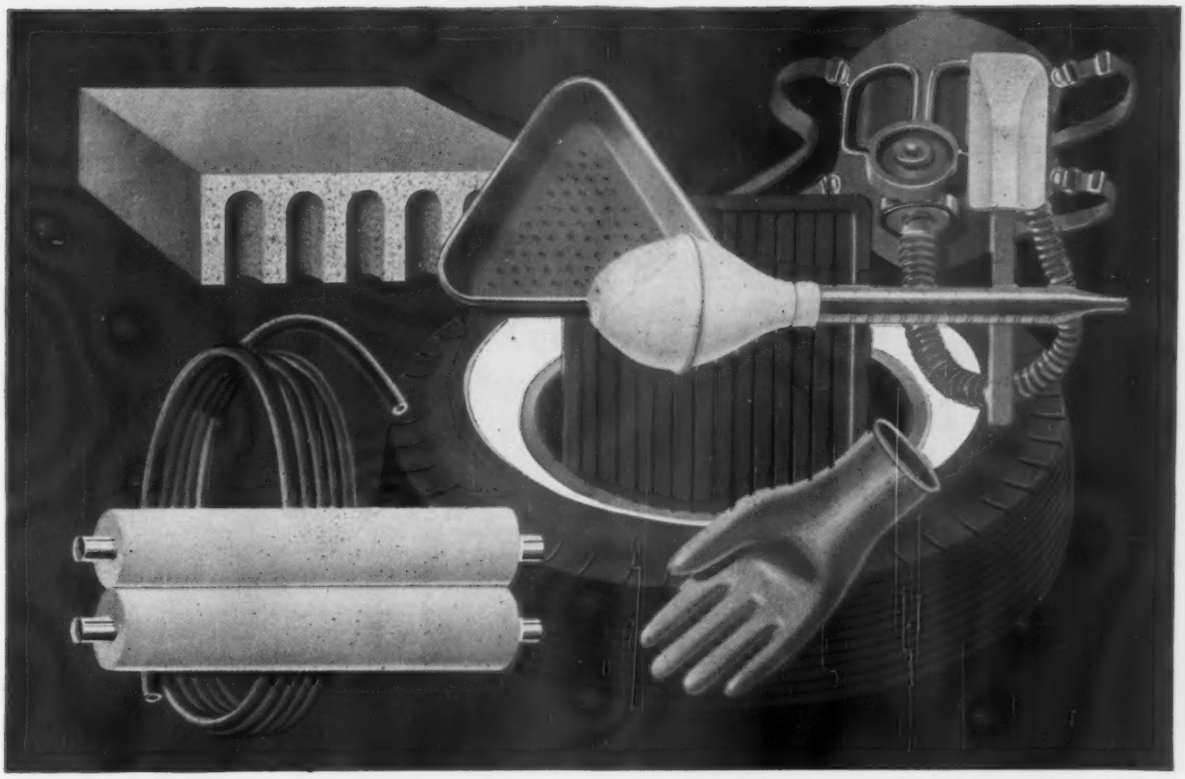
Other forms by General Porcelain:

- Gloves
- Sleeves
- Knitwrist
- Balloon
- Syringe
- Household
- Lineman
- Toys
- Gauntlet
- Ice Bag

For more information, write or telephone today! Your inquiry will receive immediate attention.

GENERAL PORCELAIN MANUFACTURING COMPANY

953 PENNSYLVANIA AVENUE, TRENTON, N. J. Telephone EXport 6-9639



You'll find Nevastain B is a superior non-staining antioxidant at lower cost

Nevastain B is an excellent non-staining, non-discoloring antioxidant developed especially for rubber manufacturers who prefer an antioxidant in the flaked form for greater convenience in compounding operations. It is shipped in sturdy 50-pound bags for easy weighing and handling. *In some instances, Nevastain B can replace products three times higher in cost,* and it has proved itself to be readily compatible with synthetic and natural rubbers, has shown no indication of blooming at more than double normal dosage, and does not interfere with the rate of cure. Write for a sample and the Technical Service Report on Nevastain B.

Neville Chemical Company, Pittsburgh 25, Pa.

Resins—Coumarone-Indene, Heat Reactive, Phenol Modified Coumarone-Indene, Petroleum, Alkylated Phenol • **Oils**—Shingle Stain, Neutral, Plasticizing, Rubber Reclaiming • **Solvents**—2-50 W Hi-Flash, Wire Enamel Thinners, Nevsolv.

NEVILLE

Please send Technical Service Report on Nevastain B

NAME *TITLE*

COMPANY

ADDRESS

CITY NC 30-RA *STATE*

Dow Corning

SILICONE COATING

ON PAPER AND PAPERBOARD KEEPS RUBBER FROM STICKING TO PACKAGES AND INTERLEAVING SHEETS.

new

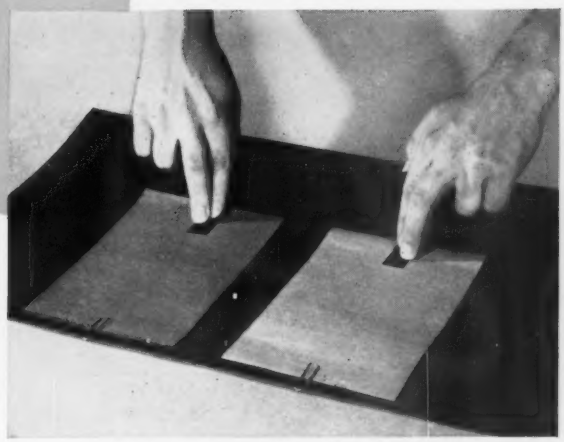
"EASY OUT" FOR STICKY

PRODUCTION ENGINEERS — PURCHASING AGENTS, you'll find it costs less to process raw materials shipped to you in paper containers with the Dow Corning SILICONE COATING.

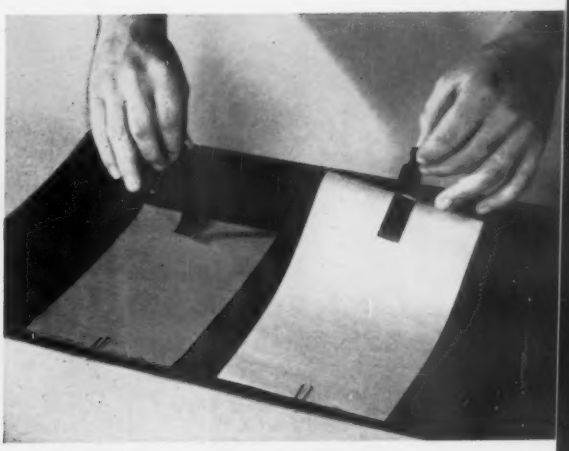
This completely new release coating provides a surface to which few sticky materials will adhere. Even the gummiest unvulcanized rubbers, camelback, adhesives, resins, sheet stock, master batch compounds can be removed from silicone coated papers—quickly, cleanly, easily. You get all the material; there's no waste.

Interleaving sheets, bags, boxes, liners, cartons, wrappers—are all available with the new Dow Corning SILICONE COATING at little or no extra cost.

Ask your suppliers to ship in containers made from paper or paperboard that has a Dow Corning SILICONE COATING.



1. **Both samples shown are of the same paper interleaving sheet. The one at left has the new SILICONE COATING. Other sample is untreated. Pressure-sensitive tape is pressed firmly to each.**



2. **When lifted, the tape applied to silicone coated paper flicks free without clinging. Tape applied to untreated paper sticks tight. Make your own test.**

RUBBER MATERIALS

Silicones Don't Contaminate — The SILICONE COATING will not contaminate your product . . . experience has proven that this coating has no effect on packaged or slip-sheeted materials. In addition, silicones are inert and nonreactive.

No Undesirable Effect on Paper . . . Dow Corning's new SILICONE COATING is colorless, odorless, and does not, in any way, alter the body or physical strength of paper or paperboard.

Coating Doesn't Migrate — SILICONE COATING remains on the surface to which it's applied . . . won't transfer through to the other surface, or to the product, even under heat and pressure.

Costs No More — For most applications, the cost of a Dow Corning SILICONE COATING is comparable to conventional non-adhesive coatings. And, because SILICONE COATING adds such little weight, freight costs are less than those for conventionally coated papers.

Permanent — The SILICONE COATING is there to stay—it doesn't come off or deteriorate. You can store rubber packaged in silicone coated paper for months and months and still obtain easy release.

Water Repellent — The SILICONE COATING is inherently water-repellent and imparts this characteristic to paper or board to which it's applied.

Free Samples ***For full information, samples of silicone coated papers, and a list of suppliers, WRITE DEPT. 9223a.***

first in silicones

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MIDLAND, MICHIGAN

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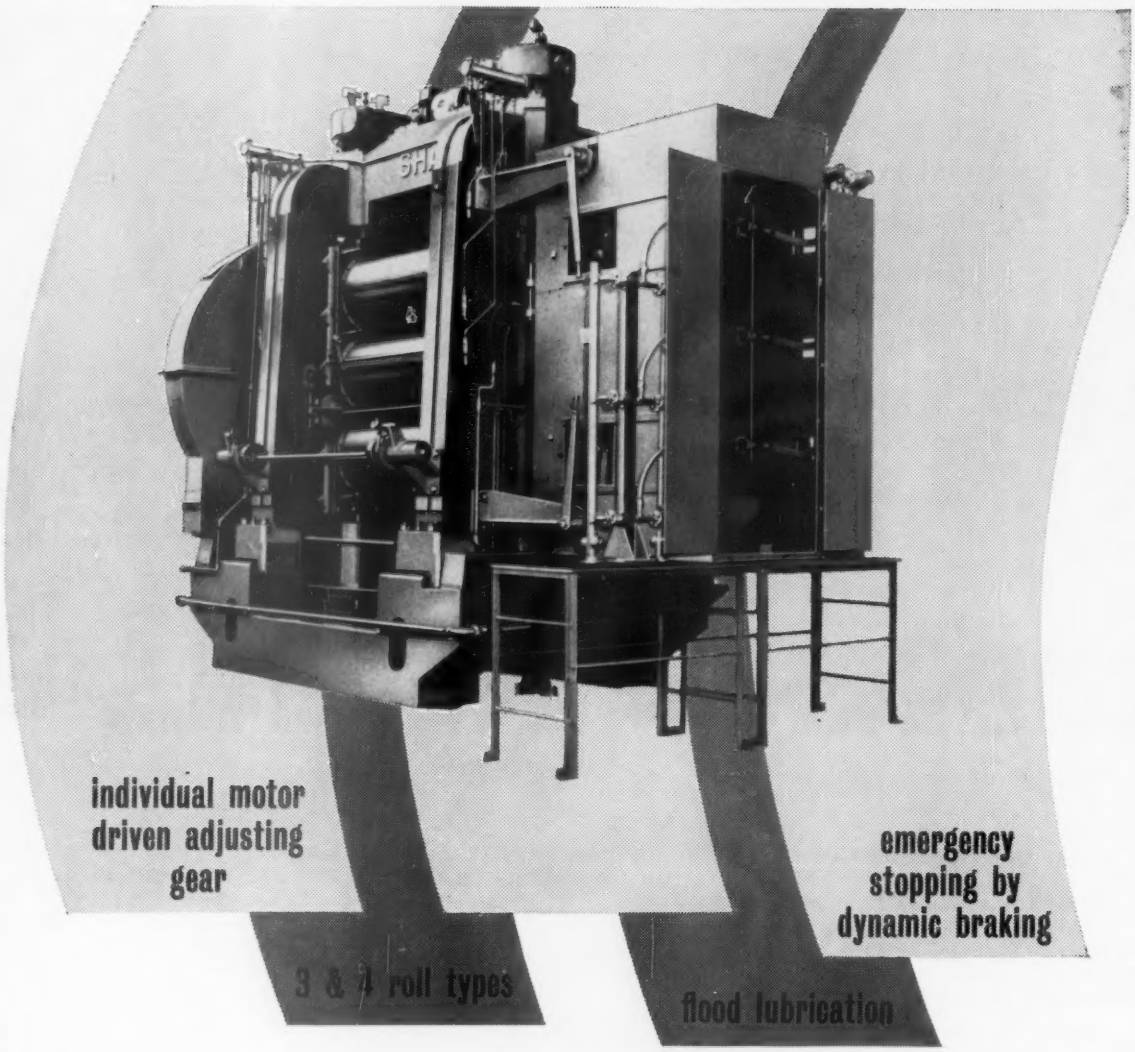
CANADA: DOW CORNING SILICONES LTD., TORONTO GREAT BRITAIN: MIDLAND SILICONES LTD., LONDON FRANCE: ST. GOBAIN, PARIS



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Shaw's outstanding design, combined with
77 years' experience and skill, has resulted in a range of
calenders representing the most advanced features
for modern production.

SHAW EXPERIENCE is at your service for advice on plant and layout

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***Enquiries* to FRANCIS SHAW (CANADA) LIMITED GRAHAM'S LANE BURLINGTON ONTARIO CANADA**

P.3797

To Save the Life of Your Tires

There are a number of barriers you can erect between your tires and ozone attack and, under special static conditions, they will afford a certain amount of protection. But, for built-in tire protection that prevents ozone cracking and checking under severe dynamic conditions as well as static, you need the safeguard of the *chemical* reactivity of UOP 88 or UOP 288 antiozonants.

Beat it, stretch it, twist it, heat it . . . the tire that's protected with a UOP antiozonant *stays* protected because UOP's widely used antiozonants form an impregnable chemical barrier, within and without, that won't chip, crack, peel or melt.

The reputation of your company rides on every tire you make. So, for longer tire life . . . "life" in the rubber, synthetic or natural . . . "life" on your dealer's racks . . . "life" on the road . . . protect your quality product with UOP 88 or UOP 288 antiozonants.

Let us send you samples of UOP 88 and UOP 288 for evaluation in your own laboratories. Or, tell us your problem and we'll be happy to recommend the correct antiozonant formulation for your product.

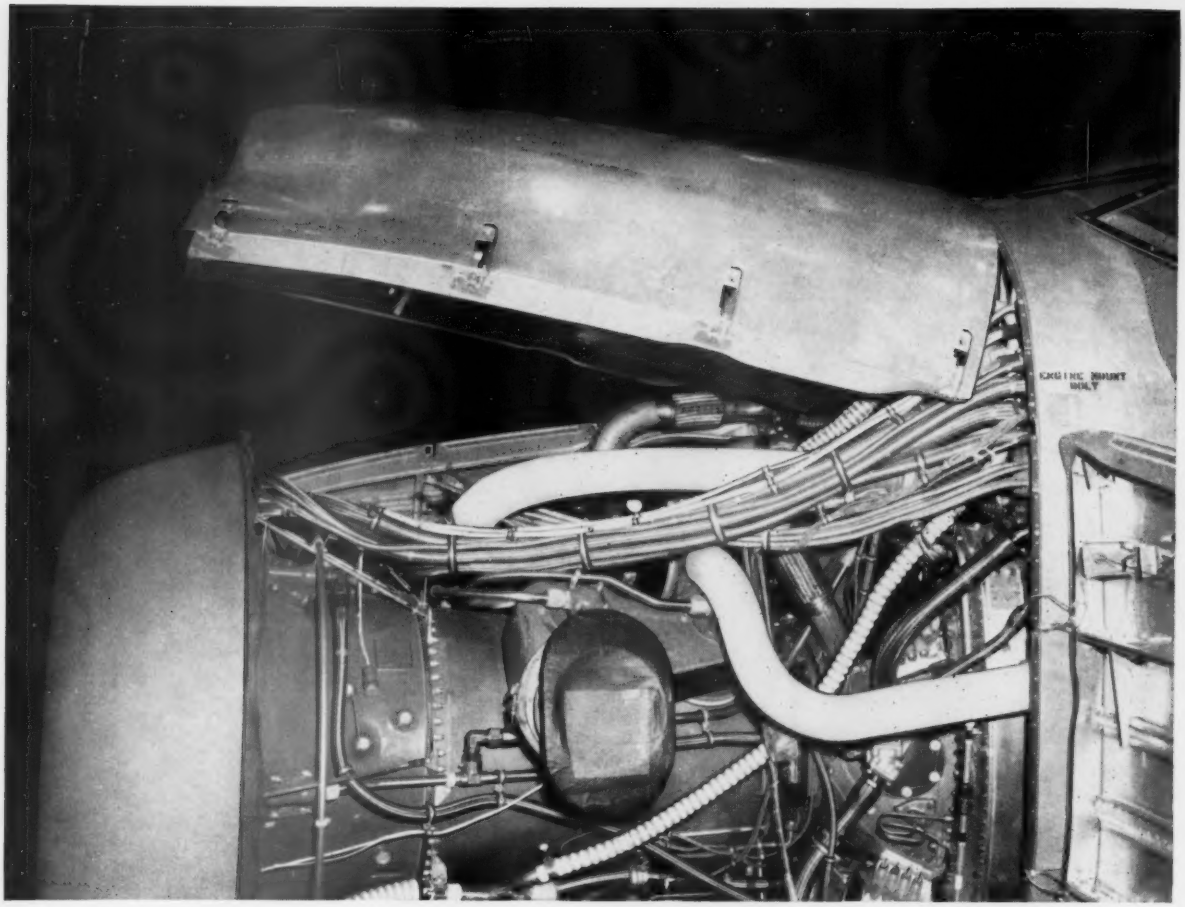
UOP 88® and 288

PRODUCTS DEPARTMENT

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

UOP®



SILASTIC 432 Base

Makes Hose Serviceable From –100 to +500F

TYPICAL PROPERTIES OF
HOSE, DUCTS AND TUBING COMPOUND
MADE WITH SILASTIC 432 BASE

	Cured 24 hrs at 480 F	Aged 24 hrs at 600 F
Temperature range, degrees F	—100 to +500	
Specific Gravity		1.27
Hardness, durometer	55	60
Tensile Strength, psi	850	770
Elongation, %	250	200
Compression Set, percent, 22 hrs at 300 F	20	18

Properties obtained on ⅛" ASTM slabs or buttons, molded 5 minutes at 240 F.

The compounding of stocks with superior physical properties for hose, ducts and tubing is easier with Silastic* 432 Base. This partially-compounded silicone rubber gum requires no bin aging after compounding, is easy to calender onto glass, dacron or nylon and can be dispersed in solvents for spread, dip or flow-type coatings. All compounds made from Silastic 432 Base retain remarkable resistance to extreme temperatures and abrasion. They have high tensile strength, good elongation and low compression set.

Do you want the recipe? *Complete instructions for compounding Silastic 432 Base for hose, duct and tubing compound is yours for the asking at the nearest Dow Corning branch office.*

FREE SAMPLE... *Try Silastic 432 Base in your own plant. Write today. Address Dept. 9223.*

A team of compounding and fabricating experts is available for visits to your plant. If you would like this team to work with your group, contact your Dow Corning representative.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

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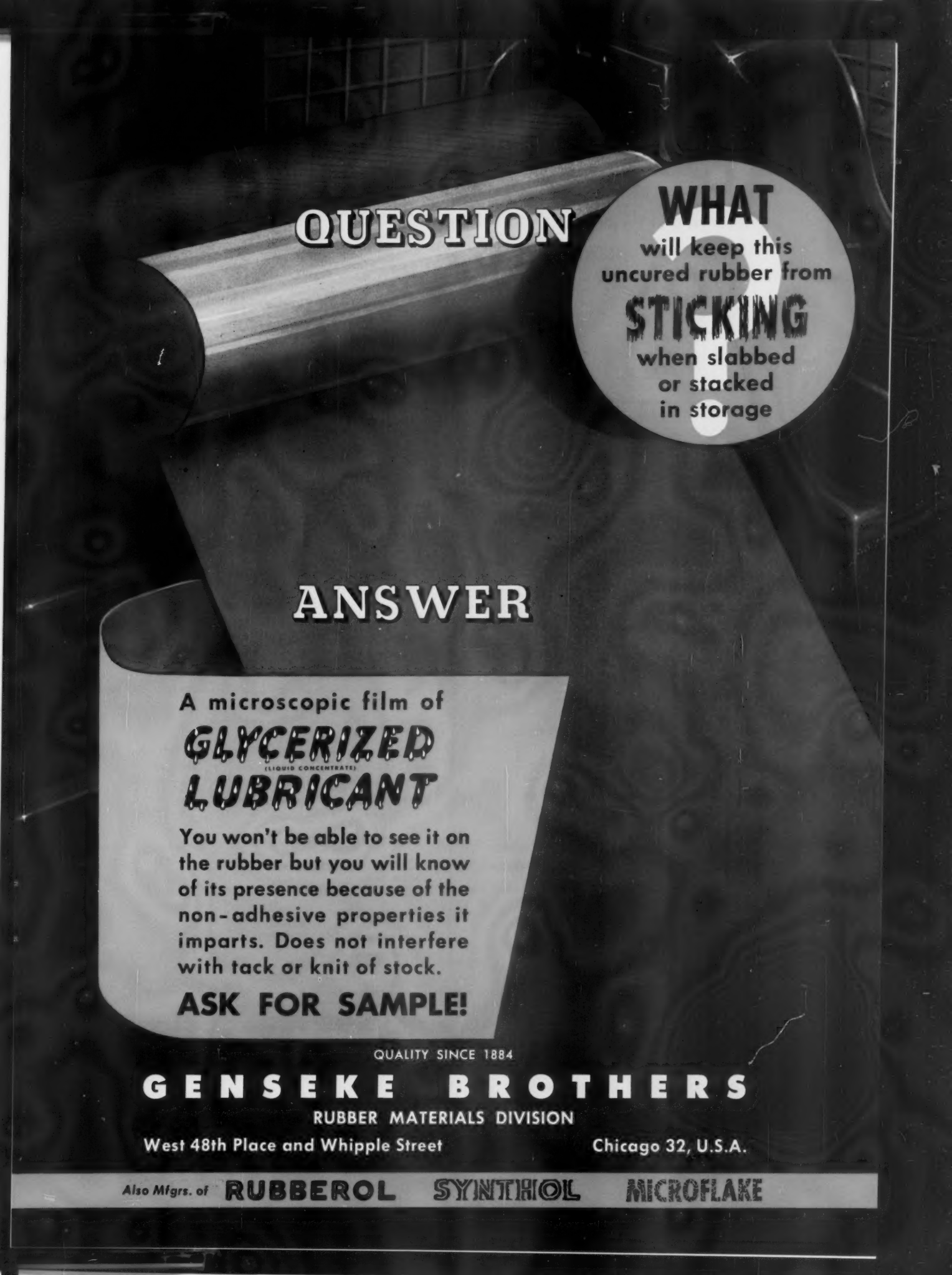
*T. M. REG. U. S. PAT. OFF.


QUESTION
WHAT
will keep this
uncured rubber from
STICKING
when slabbed
or stacked
in storage
?
ANSWER
A microscopic film of
GLYCERIZED
(LIQUID CONCENTRATE)
LUBRICANT
You won't be able to see it on the rubber but you will know of its presence because of the non-adhesive properties it imparts. Does not interfere with tack or knit of stock.
ASK FOR SAMPLE!
QUALITY SINCE 1884
GENSEKE BROTHERS
RUBBER MATERIALS DIVISION
West 48th Place and Whipple Street
Chicago 32, U.S.A.
Also Mfgrs. of RUBBEROL SYNTHOL MICROFLAKE

Here's why Cab-o-sil® is an Excellent Flow Control Agent for Butyl Rubber Compounds

Cab-o-sil® is one of the most exciting non-black reinforcing pigments ever developed to meet the rigid requirements of butyl and all types of rubber. With a finer particle size (0.015-0.020 micron) than even the finest of rubber reinforcing carbon blacks (0.023 micron) Cab-o-sil is called the SAF — Super Abrasion Furnace — pigment of the silica field. Unique in many respects, it is manufactured by a flame process similar to that used for the production of the highly reinforcing (SAF) carbon blacks and not by the aqueous precipitation process utilized by most silica producers. This results in remarkable properties and functions, and is the reason why Cab-o-sil has proved tremendously effective in all types of rubber compounds.

Almost chemically pure 99.7% silica), and composed of well defined particles of extreme fineness, Cab-o-sil is anhydrous, and has extremely low water adsorption and an enormous external surface area (175-200 $m.^2/gm.$). Cab-o-sil is not a *filler* — it is a *performance controller* — important in amounts as small as 5-7 parts per hundred butyl rubber to the improvement of numbers of compounds.

At low loadings Cab-o-sil performs several important functions in all types of butyl rubber applications. Laboratory and factory tests show that Cab-o-sil can make any and all of the following butyl rubber improvements.

Acts as a thixotropic agent
Eliminates cold flow
Reduces nerve of "green" stock, increasing the extrusion rate in some cases by 400%
Minimizes die swell
Aids dispersion of non-reinforcing fillers such as clay
Gives faster and better dispersion of color pigments
Gives good weatherability, ozone resistance and insulation resistance
Gives high tensile
Gives good stiffening effect
Contributes superior electrical properties

See for yourself how

- 5-7 P.H.R. Cab-o-sil in butyl rubber wire and cable compounds eliminate cold flow, reduce nerve of "green" stock, improve the extrusion rate, minimize die swell, have a definite thixotropic effect, and aid the dispersion of hard clays commonly used in such compounds.
- At low loadings, Cab-o-sil improves color development in weatherstripping and other colored butyl compounds, thereby reducing expensive pigment requirements and also improving extrusion and minimizing cold flow before curing.
- Cab-o-sil lends itself to the new "hot milling" technique by reducing the risk of depolymerization in a properly compounded stock. 6-8 P.H.R. Cab-o-sil give the aforementioned desirable results in wire and cable compounds plus greatly increased tensile strength, good stiffening effect and superior electrical properties. Low loadings of Cab-o-sil also control flow and give good thixotropy and thickening to rubber solutions, neoprene and other rubber-based adhesives.

For recipes, and further information on how Cab-o-sil is being used effectively in small quantities to improve various butyl rubber compounds, send today for the bulletin "Cab-o-sil in Butyl Rubber."

CHEMICAL and PHYSICAL PROPERTIES

Silica Content (Moisture-Free Basis)	*99.0–99.7%*
Free Moisture (105° C.)	*0.2–2.0%*
Ignition Loss (1000° C.)	*0.2–1.0%*
CaO, MgO	*0.00%*
Fe_2O_3	*0.004%*
Particle Size Range	*0.015-0.020 micron*
Surface Area (Nitrogen Adsorption)	*175-200 $m.^2/gm.$*
Specific Gravity	*2.1*
Color	*White*
Refractive Index	*1.55*
pH (4% Aqueous Dispersion)	*3.5–4.0*
Apparent Bulk Density (Compressed Grade)	*6.0–6.5 lbs./cu. ft.*

CABOT. WHITE PIGMENTS DIVISION RA **GODFREY L. CABOT, INC.,** 77 FRANKLIN ST., BOSTON 10, MASS.

Please send me a free sample of Cab-o-sil and a copy of the bulletin "Cab-o-sil in Butyl Rubber" ((#crub-2)

NAME_____
TITLE_____
COMPANY_____
ADDRESS_____

Cure-alls won't improve your digestion...

...but Velsicol custom made reclaiming oils will!

Rubber reclaimed by the alkali, pan-process or neutral digester process swells more readily, has lower tailings, has desirable plasticity, and is easier to incorporate into synthetic or natural rubber when you use Velsicol reclaiming oils custom-made for your operating conditions. Let a Velsicol representative study your needs, and make recommendations. No cost or obligation.

LOOK FOR THIS MAN Your Velsicol representative . . . a qualified chemist who will help you make better products for less!

Mail the coupon now for free technical literature!

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☐ Please have a salesman call to discuss custom made reclaiming oils
☐ Please send a sample for pilot plant use.
☐ Please send technical literature. RA-117

Name_____
Company_____
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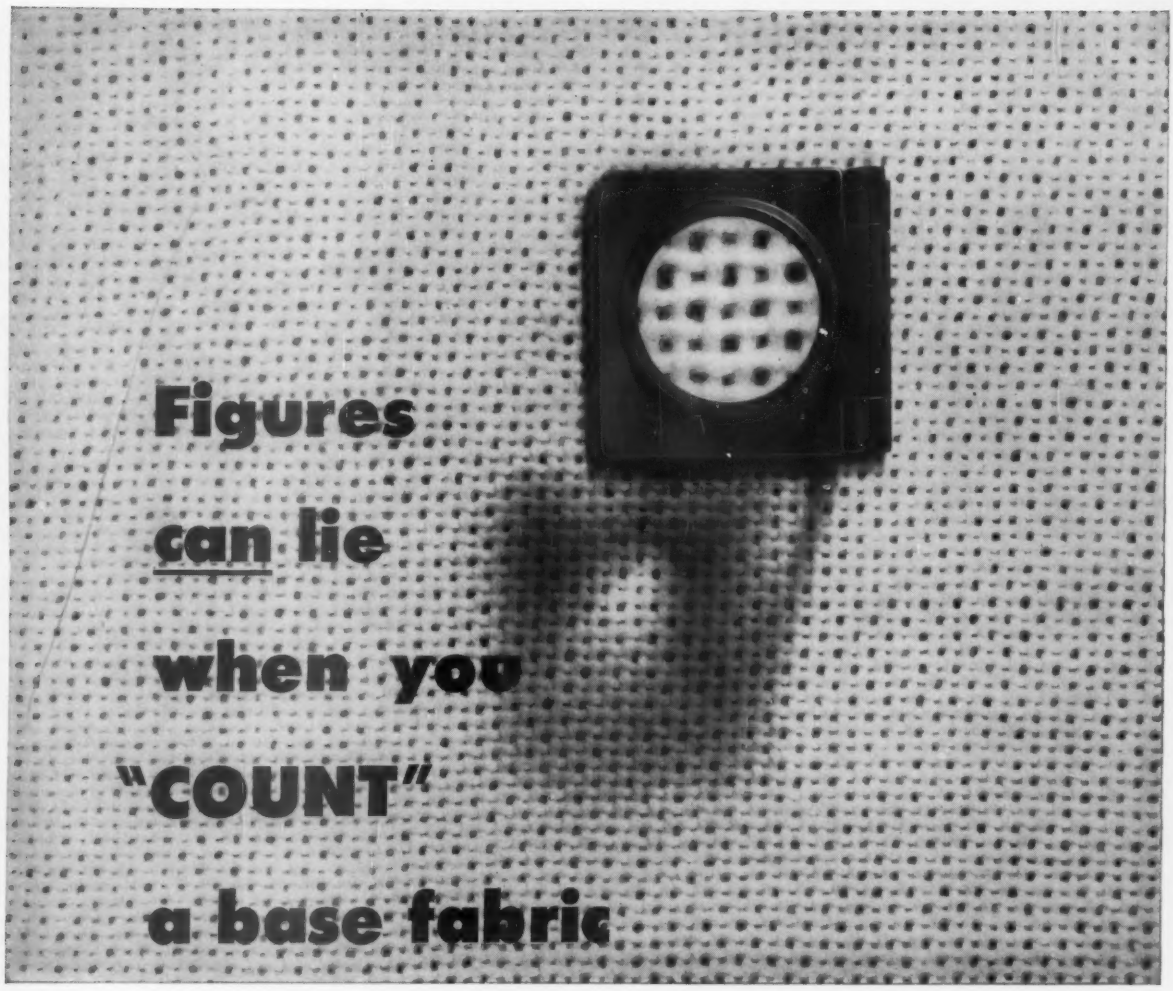
City_____ Zone____ State_____



Yarns-per-inch "count" of grey fabric can be completely misleading because of changes produced by finishing and subsequent processing!

"Count" tells how open or tight a woven fabric is. The number of yarns per inch of cloth affects absorbency, adhesion, permeability, strength, bulk, flexibility and other characteristics related to fabric-reinforced plastic or rubber products. But if count is taken in the "grey," dimensional changes caused by pre-shrinking, heat-setting, calendering, napping, singeing, pre-dipping or other processes will not have been considered—and end-product performance may suffer.

Of course, thread count is but one of many factors affecting fabric performance. When your base fabric is one of the wide variety provided by Wellington Sears for coating, laminating, combining and rubberizing, you know that everything has been considered in the light of *your specific need*. And moreover you know that a century of experience is working for you, to anticipate and help solve your basic fabric problems. For free booklet, "Fabrics Plus," write Dept. G-11, Wellington Sears Co., 65 Worth St., New York 13, N. Y.

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For the Rubber, Plastics, Chemical, Metallurgical, Automotive, Marine and Many Other Industries

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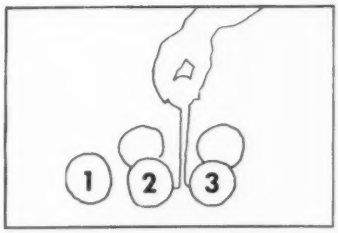
Non-staining extending oil

For light-colored rubber



Iron Pyrophosphate Recipe
1. GRS-1707
2. Base Polymer (top) and Dutrex Oil Masterbatch (37.5 phr.)

Sulfoxylate Recipe
3. Base Polymer (top) and Dutrex Oil Masterbatch (37.5 phr)

Shell Dutrex 33 is an entirely new light-colored, compatible naphthenic extender for butadiene-styrene rubber. The outstanding non-staining, non-discoloring properties of Dutrex 33 are retained in oil masterbatch vulcanizates even after severe sunlight exposure.

Dutrex 33* provides superior light color in oil masterbatch based on conventional iron pyrophosphate recipes, but its maximum advantages are fully realized in sulfoxylate base polymers. Regardless of recipe, Dutrex 33 is recommended in oil masterbatch for applications where discoloration and contact or migration staining are critical.

For further information write or call Shell Oil Company, 50 West 50th St., New York 20, N. Y., or 100 Bush St., San Francisco 6, California.

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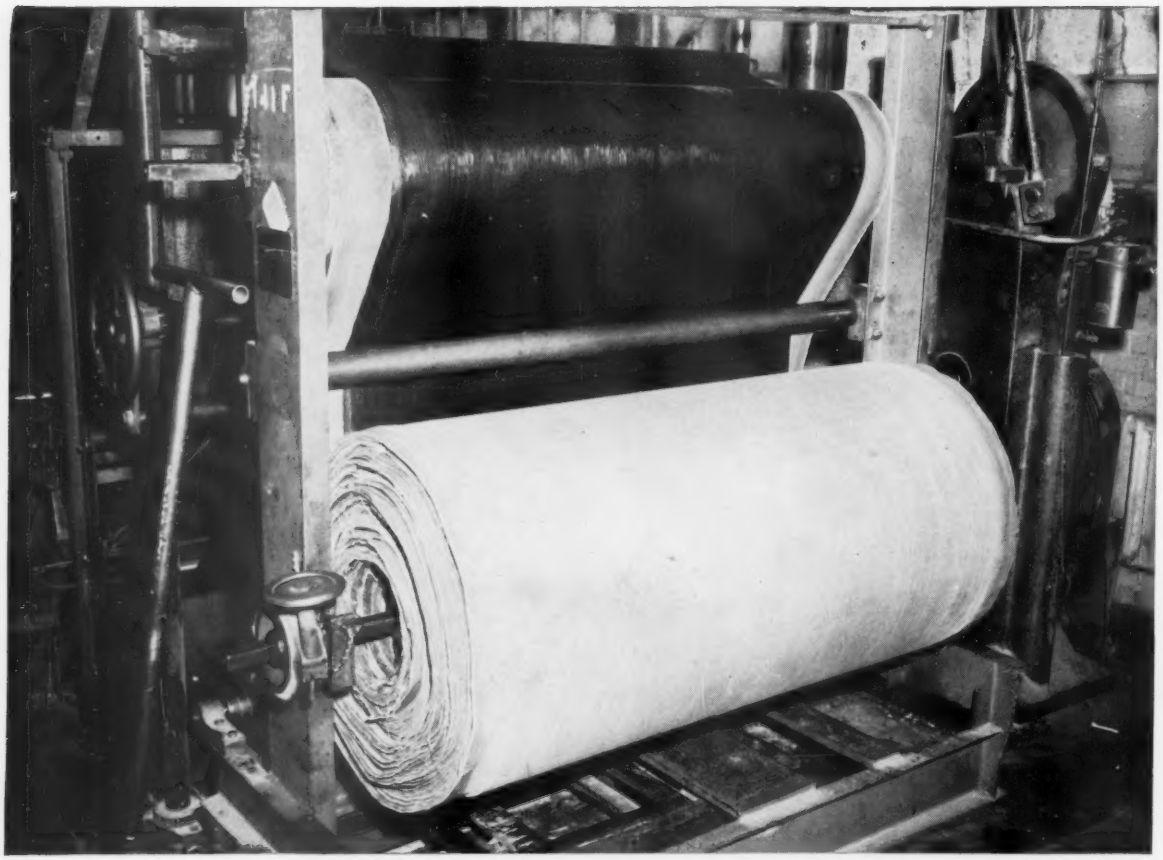
SHELL DUTREX 33

SHELL



CLIMCO PROCESSED LINERS

Eliminate Adhesions at the Bias Cutter

If your stock has been stored in a Climco Processed Liner, you can depend on easier, faster production, and the stock always separates from the liner cleanly, easily.

And Climco Processed Liners preserve the tackiness of the stock; exclude mould, bloom and sunlight. Rejects and losses due to gauge distortion are sharply reduced.

To speed production and to lengthen liner life, Climco Processing has been accepted in the rubber industry for 31 years. For superior liners, try Climco Processed Liners.

THE CLEVELAND LINER & MFG. CO.
5508 Maurice Ave. • Cleveland 27, Ohio

GET THE FULL STORY ON CLIMCO PROCESSING

Illustrated booklet tells about Climco Liners and Linerette separating paper. Tells how to get better service from liners. Write for your copy now.

LINERETTE INTERLEAVING PAPER
Treatment Contains
NO OIL OR WAX
Samples on Request

CLIMCO
PROCESSED LINERS

FOR FASTER, BETTER PRODUCTION AT LOWER COST

THE CLEVELAND LINER & MFG. CO. TRADE CLIMCO MARK CLEVELAND, OHIO, U.S.A.

Vertical Continuous Vulcanizing

...a totally new concept in wire insulation

ANNOUNCEMENT TO THE INDUSTRY

Problems of transformation, scuffing, flattening and scoring in the curing of thick, spongy insulation have been eliminated by Vertical CV. Already in commercial use, Davis-Standard Vertical CV machinery delivers cable insulation of better concentricity, more uniform diameter and improved values in dielectric strength and corona level tests.

There are numerous advantages to drawing the insulated wire downward through the vulcanizing tube:

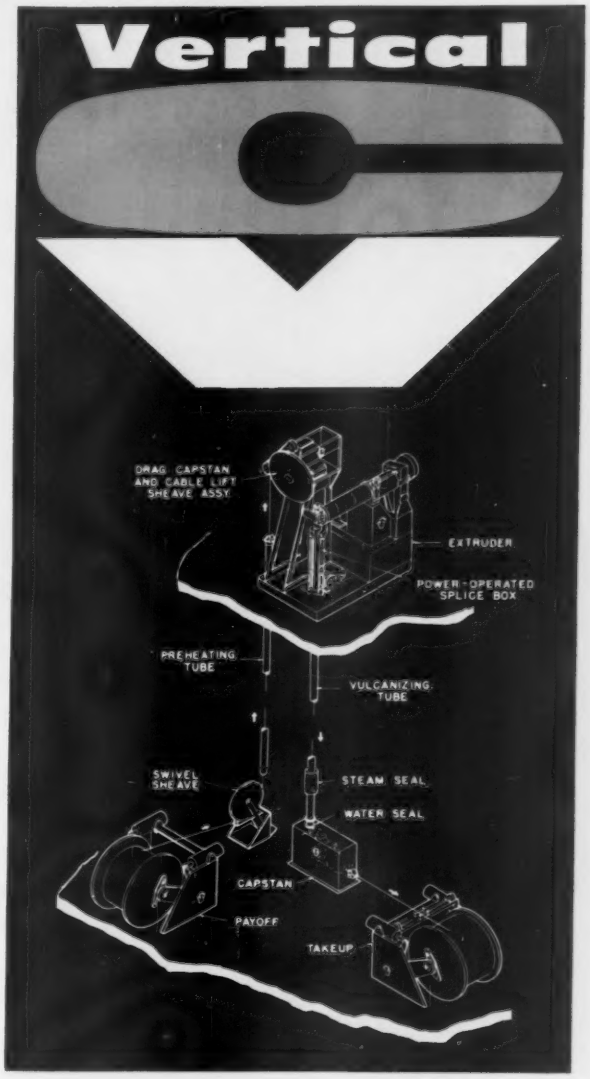
The easily damaged, uncured insulation does not come in contact with the vulcanizing tube until it has been vulcanized by steam and water.

The Drag Capstan, located above the Extruder, can be used to retract wire from the vulcanizing tube.

Vertical CV does not require the valuable floor space occupied by the conventional horizontal vulcanizing process.

Pay-Off, Capstan and Take-Up machinery are located on one floor for convenient reel-handling and operating adjustments.

The desirable feature of pre-heating the wire can be readily accomplished as it travels upward to the extruder.



We are prepared to discuss the application of Davis-Standard's Vertical CV machinery to your wire insulating line.

DAVIS-STANDARD

Division of FRANKLIN RESEARCH CORPORATION

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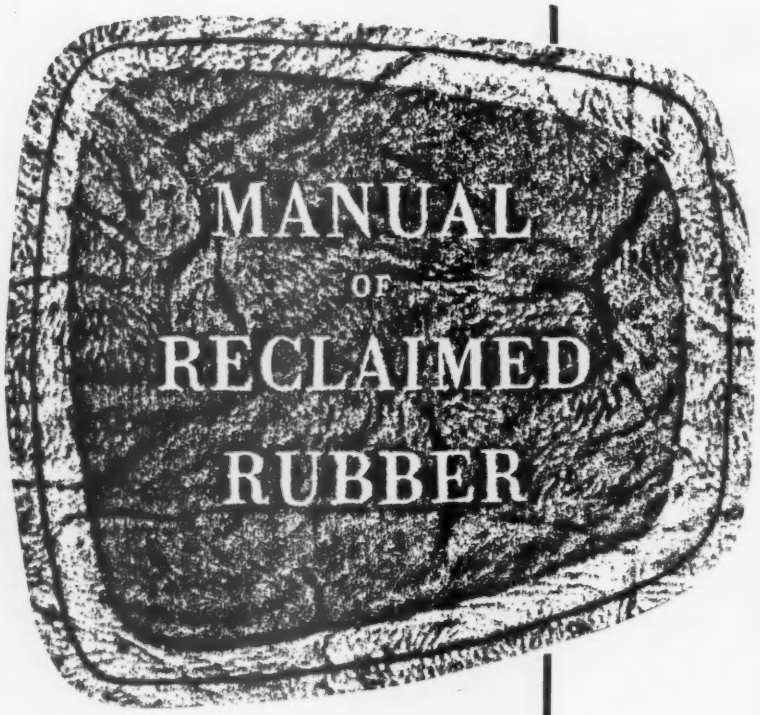

the definitive text for all who work with

rubber

SCOPE

With the objective of making available to the compounders of the rubber industry a working knowledge of reclaimed rubber, the members of the Rubber Reclaimers Association have published this "Manual of Reclaimed Rubber". Included are technical data, typical formulae (including specific gravity, costs and physical properties), types of reclaim available, names of suppliers, commercial uses and an appendix of general information. This valuable reference work, edited by John M. Ball, will be a welcome addition to any technical library.

94 Pages **$3.00**

CONTENTS

I—What is Reclaim?
II—Advantages of Reclaimed Rubber
III—Types of Reclaimed Rubber
IV—Compounding of Reclaimed Rubber
V—Commercial Uses of Reclaimed Rubber
VI—Appendix
VII—Index

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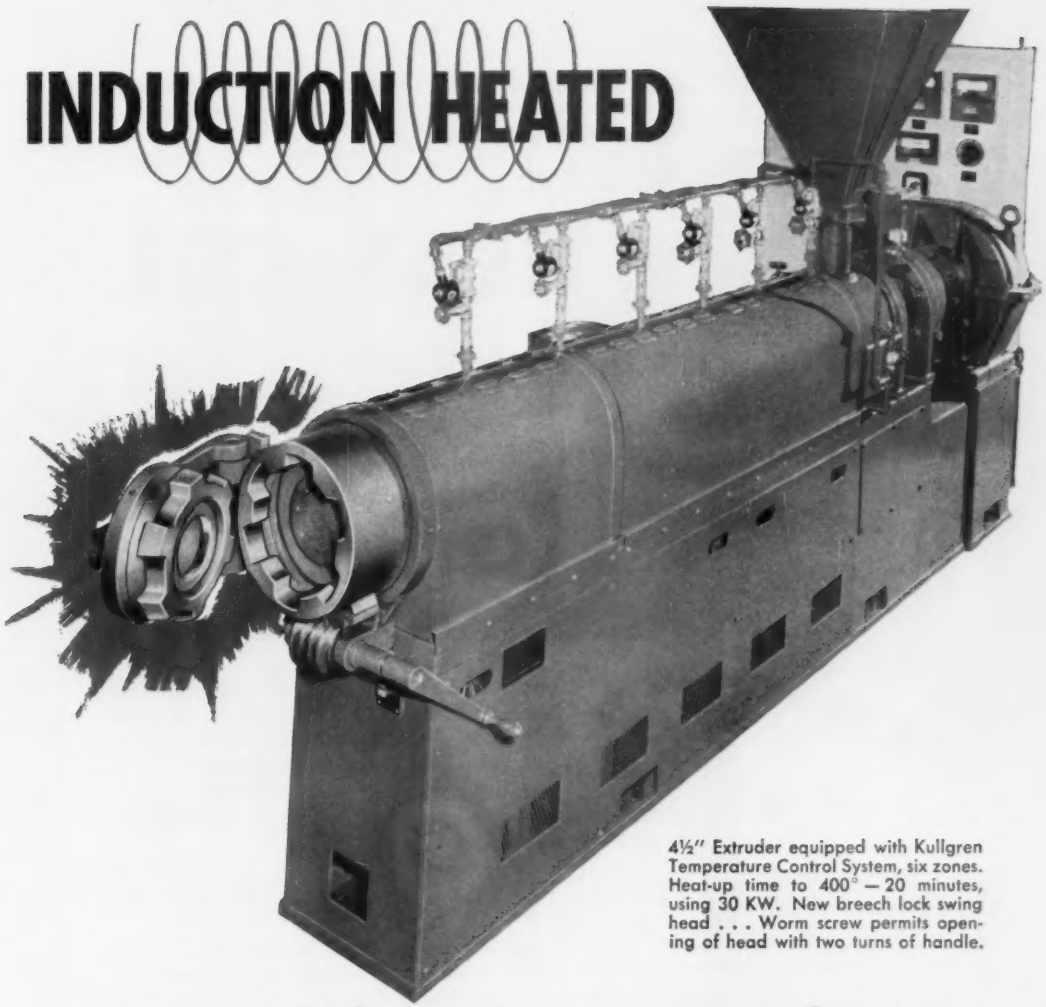

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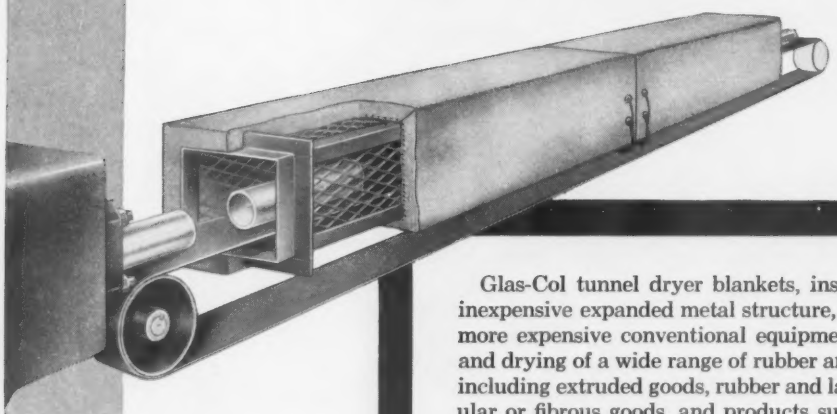

Glas-Col tunnel dryer blankets, installed around an inexpensive expanded metal structure, can do the job of more expensive conventional equipment for the curing and drying of a wide range of rubber and vinyl products including extruded goods, rubber and latex thread, granular or fibrous goods, and products such as mattresses, pillows, and upholstery.

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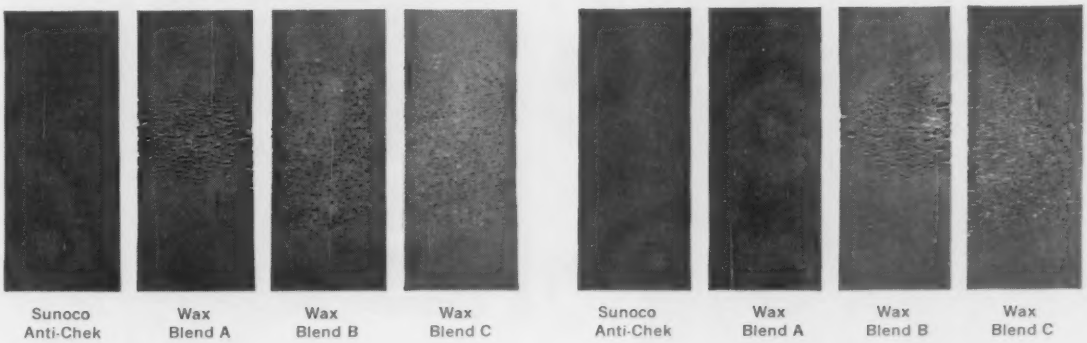

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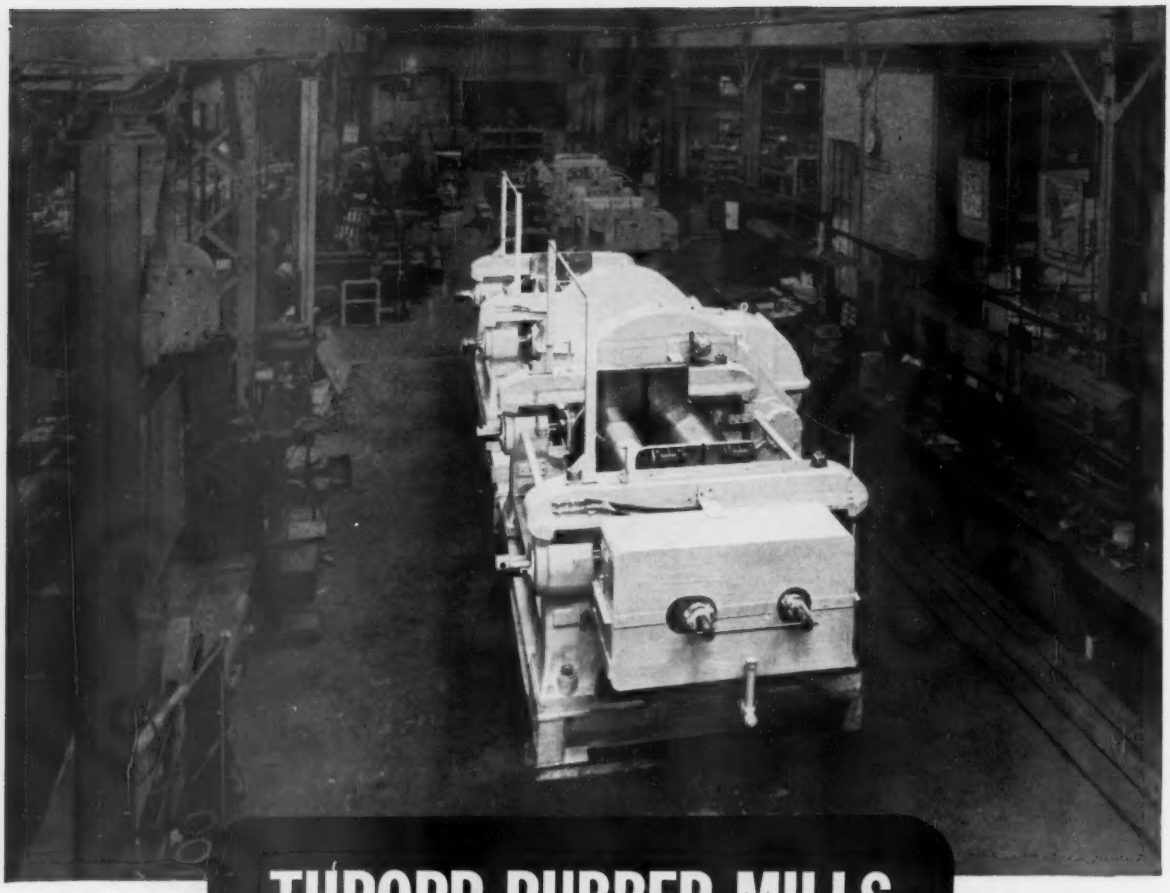

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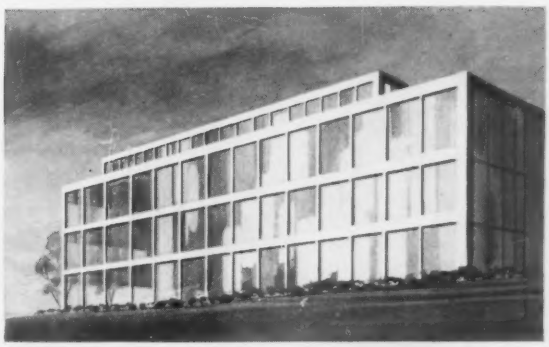

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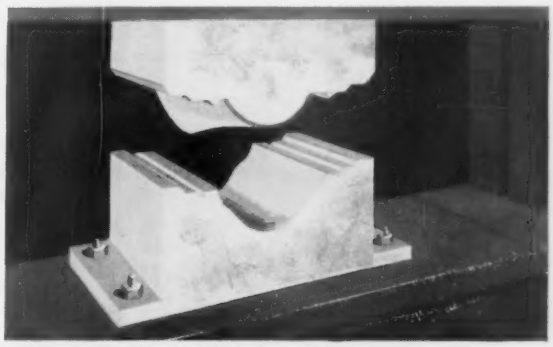
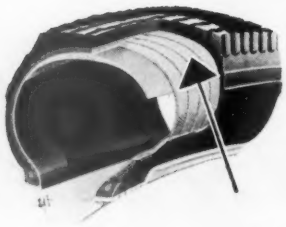
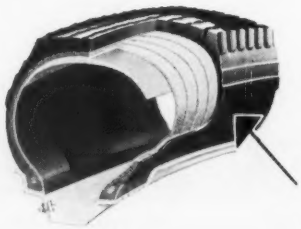




COMING AND GOING



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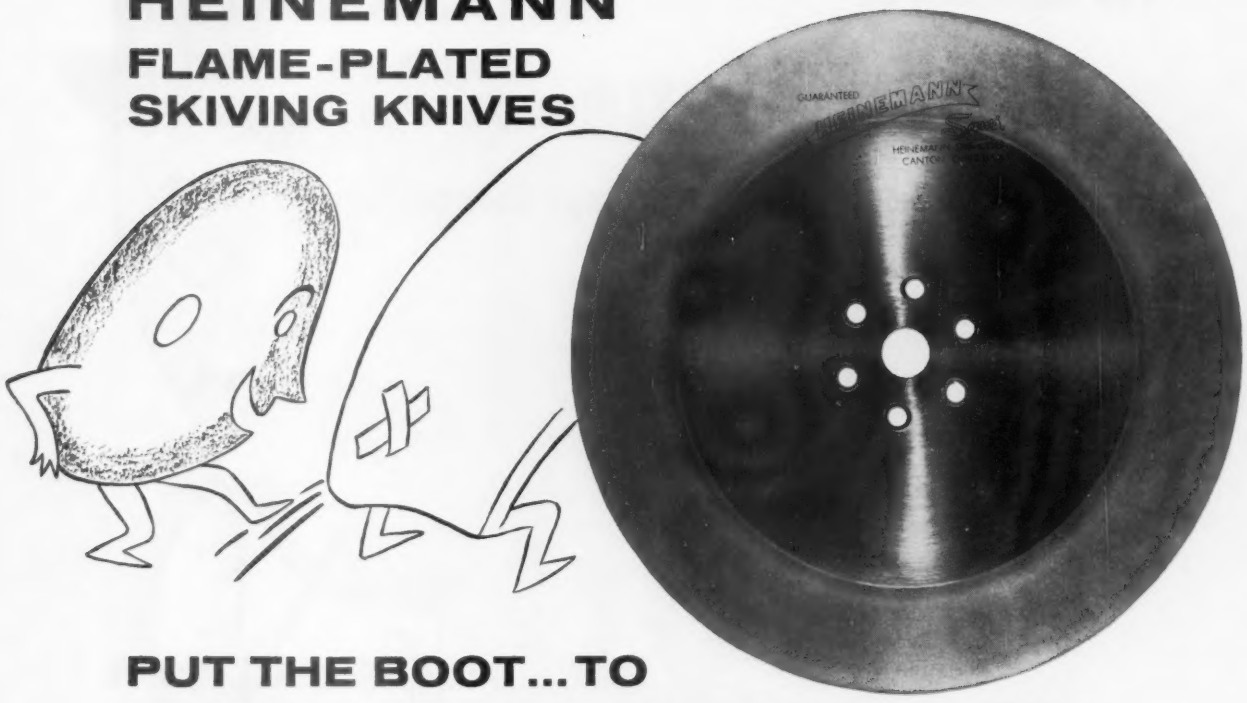

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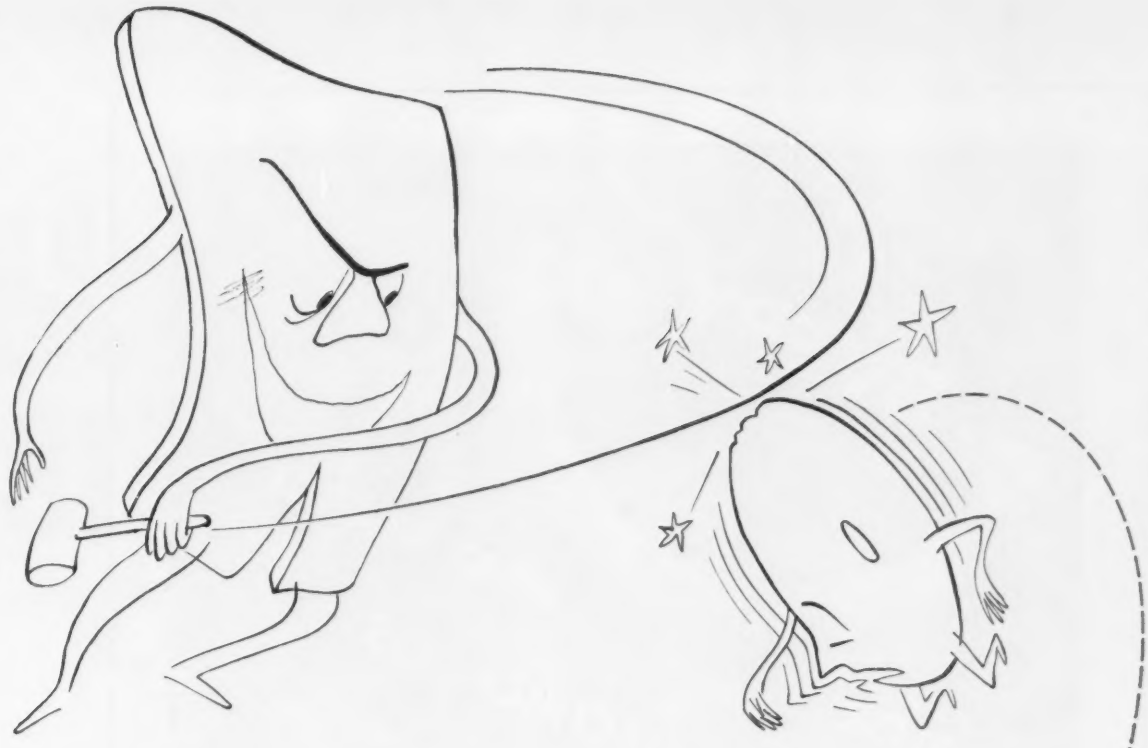

No matter how they sliced it, RUBBER dulled their SKIVING KNIVES

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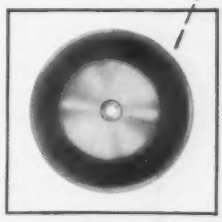

The machinery and equipment you use to fabricate rubber can have its service life greatly extended at critical points of wear by Flame-Plating. For more information, write for a free copy of the booklet, "Flame-Plating," F8065. Address Flame-Plating Dept., LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Offices in other principal cities. *In Canada:* Linde Company, Division of Union Carbide Canada Limited.

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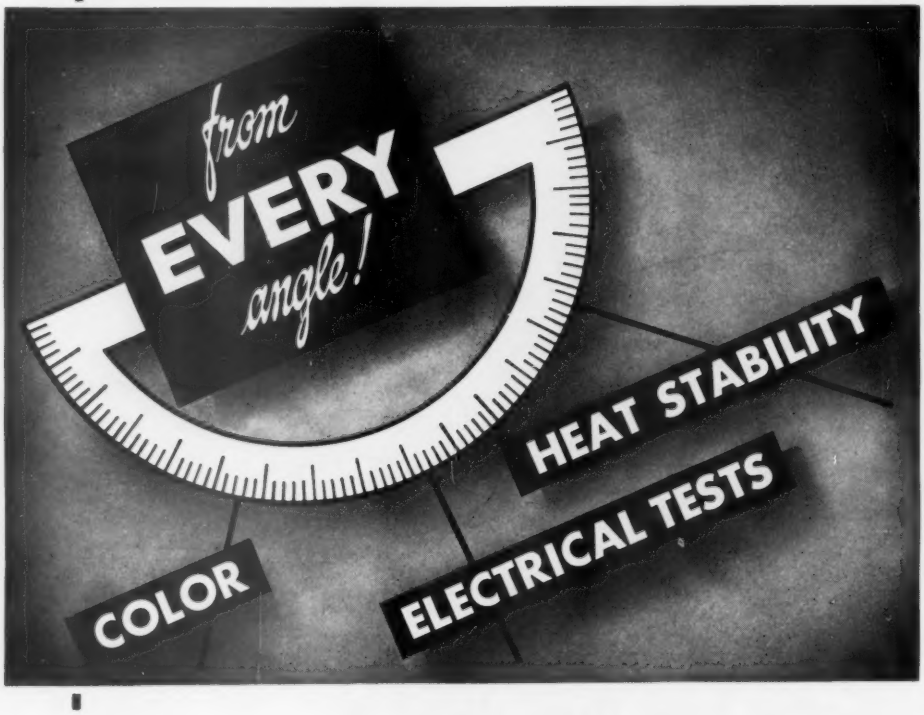

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*POLYCIZER 562 – (Octyl Decyl Phthalate)
*POLYCIZER 632 – (Didecyl Adipate)
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US RUBBER

Rubber Age

Vol. 82, No. 2 November, 1957

A Comparison of Instruments

Used to Determine

Suitability of Elastomers for Low Temperature Service

Part II: Stress Decay

By M. HANOK, J. Z. LICHTMAN, C. K. CHATTEN and G. ADLER*

Material Laboratory, New York Naval Shipyard, Brooklyn 1, New York

THE Bureau of Ships, Navy Department has a continuing interest in the development of elastomer products that will give satisfactory service in the fleet over a wide range of exposure temperatures. As part of this development program, the Material Laboratory, New York Naval Shipyard, was assigned the task of investigating and devising instruments and procedures for evaluating the low temperature serviceability of these products. Within the Bureau of Ships, over-all guidance for this and related elastomer development programs is provided by T. A. Werkenthin.

As discussed in the first article in the series *(1)*, a large number of tests have been developed by industrial and Government rubber laboratories for determining the effects of low temperatures on elastomers. These include measurements of hardness, stress decay, flexibility, recovery, brittleness and resilience. The first article dealt with hardness; this article is concerned with the determination of stress decay and is an elaboration of a paper presented at a recent symposium *(2)*. Other articles by the authors will deal with the remaining properties listed.

The stress decay phenomenon is especially important in elastomeric items where conditions of constant strain are maintained for extended periods of time. It is a measure of the decrease in stress with time of a material under conditions of essentially constant strain. Under these conditions most elastomers exhibit varying rates of stress decay which affect the serviceability of parts, such as gaskets, seals and similar components. The stress decay ratio (SDR) of an elastomeric specimen is defined as follows:

$$SDR = \frac{S_o - S_t}{S_o}$$

where S_o = initial stress, and

S_t = stress after a given time, t.

Another more conveniently used quantity is the stress retention ratio (SRR). This is defined as follow:

$$SRR = \frac{S_t}{S_o}$$

The value of the stress retention ratio is equal to one minus the stress decay ratio.

One tensile and five compression type stress decay instruments were selected for study. Their general usefulness was evaluated in tests with twelve natural and synthetic rubber vulcanizates. In the experimental work, studies were made at conditioning and testing temperatures of 74°F., 0°F., and −35°F. This range was selected in order to determine the influence of low temperatures on the instruments and to evaluate the effects of first and second order transition phenomena on the stress decay properties of the elastomers. The lower temperature limit also represents an in-service low temperature requirement for elastomeric materials in Naval use *(3)*. Room temperature tests were conducted in a constant temperature room maintained at 74 ± 2°F., and 50 ± 5% relative humidity.

With two exceptions all specimen conditioning and testing operations at 0°F. and at —35°F., were performed in air in a dry-ice cooled, thermally regulated chamber *(4)* which was operated to maintain the desired temperatures within a tolerance of ± 3°F. The exceptions occurred in the operation of a tensile stress decay apparatus and a sealing pressure apparatus. For the former instrument, the specimen conditioning was accomplished as described above, but subsequent evaluation was accomplished with the specimen immersed in a dry-ice cooled alcohol bath maintained within ± 2°F. of the desired temperature. Sealing pressure measurements were also made with the jig and specimen immersed in a dry-ice cooled bath.

Specimens were either strained initially at 74°F. and then conditioned at the desired low temperature, or else were preconditioned at the low temperature for one hour or 96 hours before strain. Specimens evaluated at 74°F. were preconditioned for at least one hour at this temperature. Some convenient time, t_o, ranging from 0.01 to 0.025 hours after applying the strain, was selected as the time of the first stress reading, S_o.

The time, t_o, varied because of the nature of the respective instruments and the speed with which specimens could be loaded and readings taken. Subsequent

* Present address: Brookhaven National Laboratory, Upton, New York. The opinions and assertions expressed are those of the authors and are not to be construed as official or as representing the views of the Department of the Navy or the Military Establishment at large.

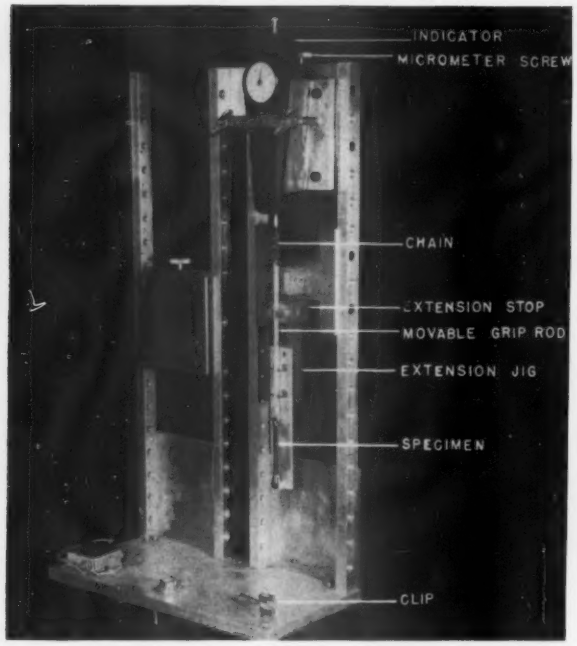

FIG. 1—Tensile Stress Decay Apparatus.

stress readings, S_t, were taken at intervals up to 22 hours, with the smallest time increments occurring during the first hour after specimen deformation. Stress retention values were calculated from the data obtained.

Twelve stocks were used for the stress decay evaluations. These were supplied by the Rubber Laboratory *(4, 5)* of the Mare Island Naval Shipyard and included a pair of stocks each of Hevea, styrene rubber, Paracril 26-NS-90, neoprene, butyl rubber and Thiokol FA polymer types. The low temperature properties of each of the twelve stocks were determined with each of the six stress decay instruments. The recipes of three representative stocks used in most of this work are presented in Table I.

Instruments used in determining the stress decay properties of elastomers are designed to subject specimens to conditions of essentially constant strain and are provided with a means of measuring the force necessary to maintain this strain. Accordingly, the instruments investigated operated by imposing either a tensile strain or a compressive strain on the elastomeric specimens. The tensile instrument and four of the five compression type instruments were designed to subject the entire specimen to strain. The fifth compression instrument, which was a sealing pressure apparatus, permitted only a small portion of the specimen to be under strain.

Tensile Stress Decay Apparatus

The Tensile Stress Decay Apparatus was designed and built by the Material Laboratory for use in evaluating the stress decay properties of elastomers in tension. This equipment *(6, 7, 8, 9)* is illustrated in Figure 1. It consists of a removable specimen elongation jig and a stress measuring assembly which is mounted on an aluminum supporting stand leveled by two rear levelling screws.

The specimen elongation jig (Figure 2) provides a means of maintaining a specimen under constant strain during measurements of stress or while conditioning the elongated specimen away from the measuring assembly. The stress measuring component is a Hunter Force Indicator, shown in Figure 1. Two of these indicators were used interchangeably according to the magnitude of the measured stress, one indicator having a 500 gram capacity and the other a 5000 gram capacity. The indicator is mounted on a carriage assembly which may be moved upward or downward by means of a micrometer screw located at the top of the instrument. The lower end of the indicator is coupled to the removable specimen grip through a flexible, three link ladder-type chain.

T-50 specimens *(10)* measuring one inch long by 0.075 inch wide in the constricted portion, and having a uniform over-all thickness ranging from 0.063 to 0.073 inch, were used in all tests with the Tensile Stress Decay Apparatus. These specimens were mounted in separate extension jigs and conditioned in the thermally regulated chamber in the unstressed state for an appropriate period of time as described above. Then each jig, in turn, was transferred from its air environment to an open Dewar flask containing a mixture of ethyl alcohol and dry-ice at the same temperature as that of the conditioning cabinet. The flask was positioned beneath the carriage assembly of the apparatus and the extension jig was then mounted on the jig support with the specimen still immersed in the fluid medium.

The specimen was elongated 100% in an interval of less than one second by raising the upper specimen grip. It was held in place at the stop with a clip, as illustrated in Figure 2, and the jig was coupled to the Hunter indicator through a chain. The indicator was elevated by rotating the micrometer screw in order to apply a tensile load to the rod in excess of the anticipated specimen stress and the clip, used to prevent retraction of the specimen, was removed.

In evaluating the specimen stress, the load applied through the force indicator was slowly reduced at a uniform rate by lowering the indicator, until the needle showed an abrupt decrease in the rate of unloading. At this point the load shown on the indicator was equal to the tensile load exerted by the elongated specimen. In each run this load was measured three times in rapid succession and the average value was recorded as the stress value, S_o or S_t, for a given specimen.

Readings of specimen stress were made at 0.02, 0.05, 0.10, 0.20, 0.50, and 1.0 hours after initial extension of the specimen. The first of these readings was regarded as the value of S_o and subsequent ones as S_t. After the one hour readings were taken, the jig was refitted with the clip as shown in Figure 2 and transferred from the Dewar flask to the low temperature cabinet for further conditioning. Stress readings were again taken in the same manner four hours and 22 hours after initial elongation of the specimen. Tests were made on each of three specimens of each of the twelve experimental stocks, and the three results in each set were averaged.

One difficulty encountered in operation of the Tensile Stress Decay Apparatus was a consequence of the use of T-50 specimens. Elongation of these specimens produced a concentration of stress at the corners between the tab ends and the constricted portion. This resulted

in notching and tearing in the case of the Thiokol FA specimens. Although ring-shaped specimens may have been preferable in this respect, the T-50 specimens were used because they could be prepared easily with a standard die available in most laboratories.

A major source of error in this test was inherent in operation of the force indicator itself. Due to friction in the moving parts, pointer parallax, and the stress evaluation technique, errors as high as 5 per cent were produced in the load readings over the range of the scale used *(7)*.

The use of easily attached and removable test jigs permitted the simultaneous evaluation of a large number of specimens. A maximum of nine was used in this program because of limitations of the conditioning and testing schedule. The removable feature of the jigs also eliminated the need for maintaining the load measuring device at the conditioning temperature, thus avoiding sticking and binding effects due to formation of frost on the working parts.

There was always a slight decrease in specimen strain, generally less that 0.002 inch *(7)*, when measuring specimen stress. This decrease amounted to not more than 0.1% of the extended length of the specimen so that it was under essentially constant strain during all conditioning and testing operations.

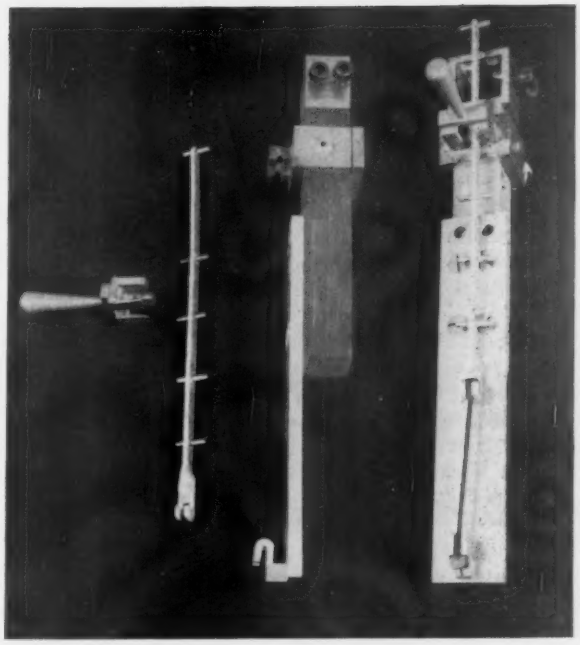

FIG. 2—Specimen elongation jig, disassembled and assembled with specimen under strain, for the Tensile Stress Decay Apparatus.

TABLE I—RECIPES OF REPRESENTATIVE EXPERIMENTAL STOCKS

Styrene Rubber Stock E-162-415
(Cure for ½ inch thickness: 25 minutes at 310°F.)

Styrene rubber	100.0
Zinc oxide	5.0
Philblack A (HMF)	50.0
Naftolen 510	20.0
Heliozone	3.0
Thionex	2.0
D.P.G.	0.4
Sulfur	0.6
Total	181.0

Thiokol FA Stock E-53-15
(Cure for ½ inch thickness: 45 minutes at 300°F.)

Thiokol FA	100.0
Zinc oxide	10.0
Pelletex (SRF)	40.0
Stearic Acid	0.5
Altax	0.3
D.P.G.	0.1
Total	150.9

Neoprene (GR-M) Stock E-156-315
(Cure for ½ inch thickness: 25 minutes at 310°F. in press plus 60 minutes at 310°F. in open steam)

GR-M	100.0
Zinc oxide	1.0
XLC Magnesia	4.0
Thermax (MT)	20.0
Paraffin	2.0
Neophax A	10.0
Circo L.P. Oil	15.0
Stearic Acid	1.0
Neozone A	2.0
Total	155.0

Compression Stress Decay Instruments

The Hi-Po-Log Strain Gage Apparatus *(11, 12)*, which was developed by the W. S. Macdonald Co., Cambridge, Mass., is a total strain type tester. Its components include a strain gage compression jig and a Foxboro Dynalog Recorder. A 0.001 inch graduated dial indicator thickness gage mounted on a stand was added by the Material Laboratory.

The compression jig, illustrated in Figure 3, consists essentially of a one-inch thick base plate, a ¼-inch thick deflection plate having four strain gages cemented to its upper central surface, two knurled loading screws five inches between centers acting on knife-edges, and serrated specimen contact surfaces on the base plate and deflection plate.

The elastomer specimens, which were cylindrical plugs, 1.129 inches in diameter by 0.50 inches thick, were preconditioned for 24 hours at 74°F. Then, the specimen to be tested was centrally positioned between the serrated surfaces of the compression jig located in the working chamber of a low temperature cabinet. This cabinet was set to operate at the temperature of test, either 0°F. or —35°F., as desired. Strain was applied to the specimen by rotating the loading screws until the specimen was compressed 0.10 inches or 20 per cent of its original thickness. Under these conditions the deflection plate acted as a centrally loaded beam.

Stress changes in the elastomer specimens produced changes in the deflection of the plates such as to maintain mechanical equilibrium. These in turn produced changes in the resistance of the strain gages, which in turn were detected, amplified and recorded by the electronically-operated Dynalog recorder in units of strain of the beam, micro-inches per inch. The recorder strain values were

used as S_o or S_t values, as they are directly related to the deflecting load and are therefore a direct function of the elastomer stress. Values of S_o were determined at 0.01 hours after the initial compression of a specimen; values of S_t were determined at 0.05, 0.10, 0.25, 0.50, 1.0 hours, and in some instances up to 46 hours after compression of the specimen.

The strain measuring and recording system of the Hi-Po-Log apparatus has a distinct advantage in its rapid and continuous response and sensitivity to small changes in stress of the compressed specimen. However, the instrument suffers from inherent defects in design of the compression jig. These include the possibility of unequal motion of the knurled loading screws with consequent lack of parallelism of the compression plates and non-uniformity of compression of the specimens. In addition, the loading screws do not afford sufficient force to compress high modulus stocks *(11)* or to obtain rapid compression of a specimen.

Material Laboratory Strain Gage Apparatus

The Material Laboratory Strain Gage Apparatus *(13, 14)*, shown in Figure 4, operates on the same principle as the Hi-Po-Log instrument. The major changes incorporated in the Material Laboratory device include the use of a twelve channel Baldwin SR-4 Bridge Balancing unit to accommodate up to twelve compression jigs simultaneously, and a sprocket-chain linkage and T-wrenches for loading the compression plate. The bridge balancing unit is designed for balancing resistances and switching of each of twelve strain gage channels into a Baldwin Strain Recorder. Individual balancing of each of the strain gage Wheatstone bridge circuits is accomplished by means of manually-operated rheostat adjustments.

The Baldwin Strain Recorder is a modified form of the Foxboro Resistance Dynalog recorder, having zero and gage factor adjustments and full scale strain ranges of 2000, 5000, and 10,000 micro-inches per inch.

Each compression loading jig, (Figure 5) consists of a ⅛-inch thick stainless steel deflection plate, a heavy base plate, a smaller removable plate having a 4/0 grade sandpaper-covered specimen contact surface, and a sprocket chain and T-wrench mechanism for equal loading of the deflection plate at two knife-edge contact points. Strain gages were cemented to the top surfaces of the deflection plates parallel to the direction of strain in the center and perpendicular to this direction near one

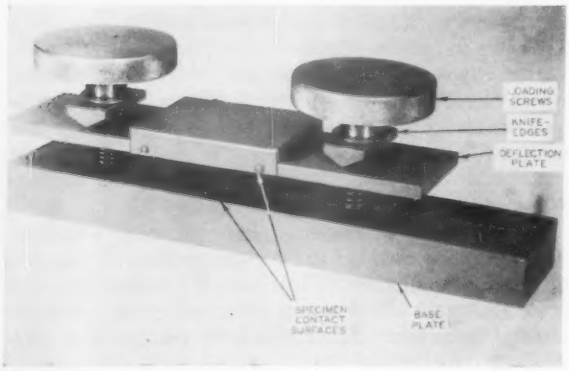

FIG. 3—Compression jig for the Macdonald Hi-Po-Log Apparatus.

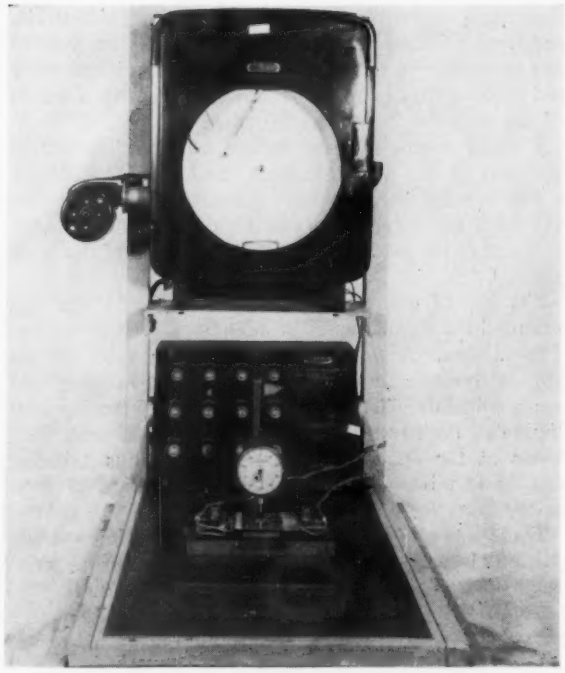

FIG. 4—Material Laboratory Strain Gage Apparatus.

of the ends, where the change of strain is negligible. The centrally placed gages detected the strain while the other gages functioned as temperature compensating components.

Baldwin SR-4 type AB-3 and A-7 strain gages *(15)* were used in tests at 74°F. *(13)* and at low temperatures *(14)*, respectively. The A-7 gages were moisture-proofed with a coat of an air-drying electrical insulating varnish *(16)*. Plastic covered No. 22 single strand copper wires *(17)*, soldered to the strain gage leads, were used to complete the circuits to the bridge balancing unit.

In using the Material Laboratory Strain Gage Apparatus, specimens 0.50 inch thick by 0.50 inch diameter were preconditioned for a period of at least one hour at 74°F. prior to compression at this temperature, and for periods of one hour or 96 hours at a temperature of either 0°F. or −35°F. for appropriate tests at low temperatures. For each test run, two preconditioned specimens were placed between the base plate and deflection plate on a line midway between and parallel to the ends of the compression jig. The sprockets were turned until a small deflection was indicated on the strain recorder chart and were then backed off until no change was noted.

At this point the dial indicator, which was in contact with the deflection plate, was set on zero. The specimens were then compressed an amount equal to 30 per cent of their initial thickness. Values of S_o were read at 0.01 hour after completing the compression of the specimens. Subsequent readings of S_t were determined at 0.02, 0.04, 0.10, 0.20, 0.50, 1, 3, 4, and 22 hours. Finally, values of S_t/S_o were calculated for each three runs at each of these time intervals, and the averages were recorded as the stress retention values for the respective elastomeric stocks.

The Material Laboratory Strain Gage Apparatus has

all of the design advantages in common with the Macdonald Hi-Po-Log Apparatus as well as several improvements. Foremost is the use of the chain linkage which insures uniformity of specimen compression. Also, the use of a number of independently loaded jigs and a switching unit permits the evaluation of stress decay rates of several specimens concurrently without disturbing the specimens at any time during a test subsequent to the initial loading.

At low temperatures, a maximum of only four test jigs could be used conveniently at any given time in the test chamber due to the spacial restrictions imposed by a total of sixteen circuit wires leading out of the chamber. At these temperatures the loading of the test jigs was impeded by the use of protective gloves required by the operator.

The moderate incidence of broken strain gage terminal wires at 0°F. and at −35°F. necessitated occasional repairs and replacement of the strain gages. This was time-consuming both from the viewpoint of repair time and loss of time of interrupted tests.

Cantilever Beam Compression Apparatus

The Cantilever Beam Compression Apparatus *(18)*, shown in Figure 6, is modeled after a stress relaxation apparatus designed by Blow and Fletcher *(19)*.

It consists of a number of individual compression jigs of Material Laboratory design, a compression clamp, a loading beam, a turnbuckle from which is suspended a load measuring dynamometer, a micrometer plate assembly, and a beam balance indicator light which is operated by a microswitch. The turnbuckle and dynamometer are supported from a steel frame 34 inches high. The compression jig, shown disassembled in Figure 7, consists of an upper and lower compression plate, each measuring 2¼ inches in diameter by ¼-inch thick and having a smooth chromium plated specimen contact surface, assembly screws and nuts, and semi-annular spacers 0.300 inches thick.

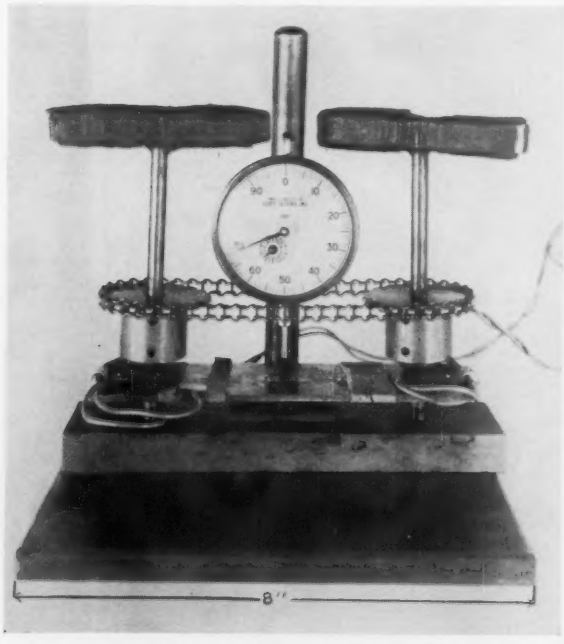

FIG. 5—Compression loading jig and stand for the Strain Gage Apparatus.

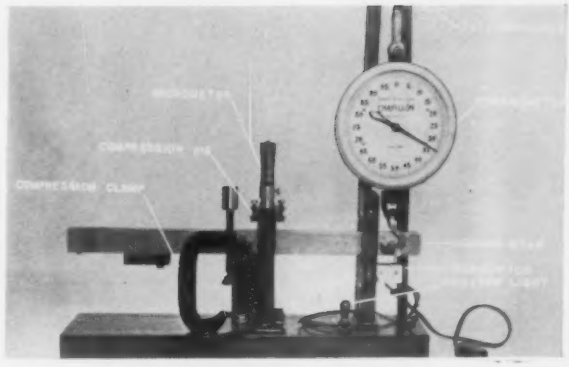

FIG. 6—Cantilever Beam Compression Apparatus with specimen jig in test position.

The test is performed by a mechanical determination of the load necessary to maintain a constant strain on the specimen as indicated by balance of the loading beam. This load is assumed to be equal to the specimen stress at the observed time.

In determining stress decay properties with the Cantilever Beam Apparatus, specimens 1.129 inches in diameter by 0.50 inches thick were preconditioned for a period of at least one hour at 74°F. for tests at room temperature, and for periods of one hour or 96 hours at a temperature of either 0°F. or —35°F. for appropriate tests at low temperatures. Each specimen was then centered between the plates of a test jig and compressed in the C-clamp to 60 per cent of its original thickness as controlled by the semi-annular spacers.

The starting time for the stress decay period was taken at the instant of full compression. The retaining nuts on the jig were tightened to maintain the specimen strain and the entire jig was transferred to the micrometer plate assembly. When the micrometer had been lowered just sufficiently to de-energize the signal lamp (on depression of the microswitch), the retaining nuts were loosened sufficiently to permit removal of the spacers. The load required to re-energize the lamp, applied by raising the dynamometer via the turnbuckle, was then determined and recorded. Initial load readings, S_0, were taken either at, or were extrapolated back to, 0.025 hours after compression of the specimen. Subsequent load readings, S_t, were taken at 0.05 0.1, 0.2, 0.5, 1, 4, and 22 hours and the S_t/S_0 ratios were calculated.

All tests were made in triplicate and the results averaged. Load values from 0.025 to 0.1 hours were taken without removing the jig from the micrometer plate assembly of the cantilever apparatus. The jig was recompressed with the spacers in place and removed from the apparatus after the 0.1 hour determination. The same procedure was repeated for each of the succeeding determinations. The entire apparatus, including the compression jigs, was conditioned at each of the test temperatures for at least one hour before use, and was maintained at the test temperature during the entire evaluation period.

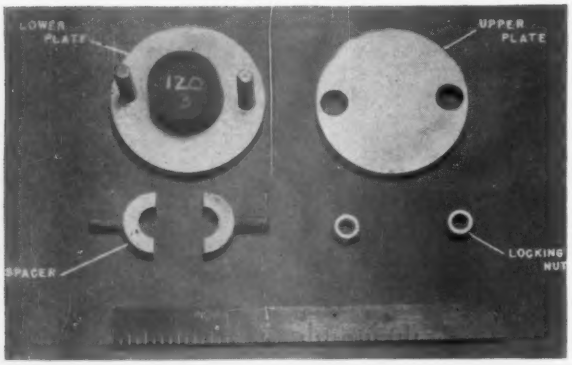

FIG. 7—Disassembled compression jig for the Cantilever Beam Compression Apparatus.

The operation of the Cantilever Beam Compression Apparatus involved a number of successive manipulations. These necessitated considerable skill on the part of the operator, especially at low temperatures where manual dexterity was impeded by the use of heavy protective gloves. Since manipulations at three different parts of the instrument were involved, the time required to make a load determination was further increased. It was difficult therefore to maintain a constant time for t_0. No part of the instrument exhibited any noticeable binding or sticking resulting from frost formation at low temperature *(18)*. The number of test jigs that were run concurrently was limited only by the time schedules of the experiment.

The repeated process of loosening and tightening the jig retaining nuts for the readings after 0.1 hour may introduce an error in retained stress. This results from the slight decompression of the specimens when the spacers are removed during a measurement which, in turn, may produce a very slight change in strain in each of the succeeding determinations. For high decay stocks the effects are more significant in the early stages of the decay process.

Autopneumatic Compression Apparatus

The Autopneumatic Compression Apparatus *(20, 21)*, shown in Figure 8, is essentially equivalent to an instrument described by Wilkinson and Gehman *(22)*. The Material Laboratory added a dial indicator beneath the loading components in order to determine specimen deflection. The pressure gage was also relocated to a position in front of the bellows to reduce the height of the instrument.

This instrument operates by controlling the air pressure in the bellows, necessary to maintain a constant specimen strain, through the use of a Schrader type relief control valve (not shown in Figure 8) located in the lower end plate of the bellows. The stem of the valve at equilibrium of load is just in contact with the cross-bar. A decrease in specimen stress causes the bellows to expand, lowering the valve stem against the cross-bar. This automatically opens the pressure relief valve, thereby correcting the unbalanced force and maintaining the specimen strain at an approximately constant value. The pressure gage therefore automatically and continuously indicates a direct function of specimen stress at any time.

Cylindrical specimens, ½-inch in diameter by ½-inch thick, were conditioned at 74°F. and 50 per cent relative humidity for at least one hour prior to test. Six specimens were then placed on the loading platform at points corresponding to the corners of a regular hexagon and were compressed approximately 40 per cent by filling the system with compressed air through the inlet valve and adjusting the cross-bar, actuating the leak control valve.

Readings of the bellows pressure were made at 0.01, 0.03, 0.1, 0.2, 0.5, 1, 4 and 22 hours after initial compression of the specimens and S_t/S_0 values were calculated on the basis of a t_0 value of 0.01 hour. Two runs were made of each material, using six new specimens for each run, and the results were averaged.

All of the stress decay values determined with the autopneumatic apparatus were obtained at 74°F. *(20)*. Low temperature tests with this instrument were unsuccessful *(21)*.

The Autopneumatic Stress Decay Apparatus has several structural deficiencies which are largely associated with its use of an air pressure system to produce and maintain specimen strain, and with the non-parallelism of the compression surfaces. Non-uniform loading together with tilting of the compression head occurred at 0°F. *(21)* and rendered the instrument unsuitable for low temperature stress decay evaluations. Air leakage in the control valve, in excess of that required to maintain the specimen strain, was evidenced during some of the tests by a decrease in specimen compression *(20)*. The compression decreased by about six mils over a 22-hour period, even at room temperature.

Low temperature effects introduced another difficulty in the control of pressure as a result of the thermal contraction of air and decrease in the bellows pressure. Still another disadvantage of the autopneumatic apparatus is

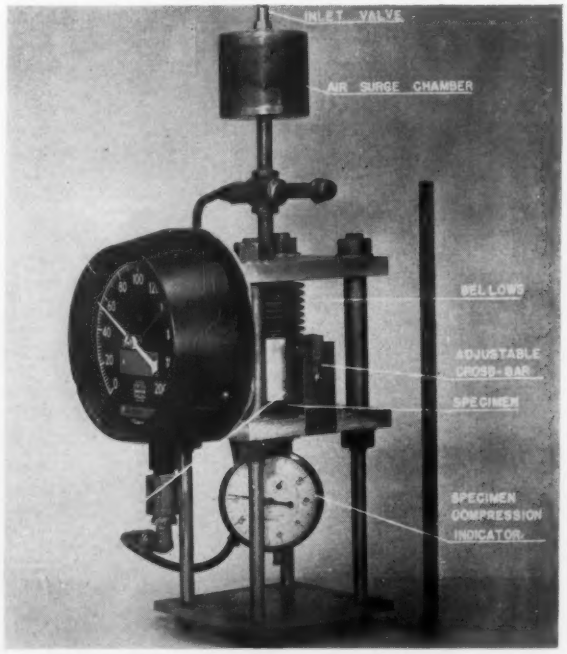

FIG. 8—Autopneumatic Compression Apparatus.

that it permits the evalution of only one polymer sample during a test run, an individual apparatus being required for each sample.

Sealing Pressure Apparatus

The NRL Precision Sealing Pressure Apparatus *(23, 24, 25)*, diagrammed in Figure 9, is a partial compression strain instrument. It consists of a base, an indentor, and a yoke joining these parts.

The specimens used in the tests were cylinders measuring 1.129 inch diameter by 0.50 inch thick. In each test a specimen was mounted in the Sealing Pressure Apparatus at 74°F. and raised sufficiently by rotation of the base relative to the yoke to form a seal against the indentor at one psi air pressure *(24)*. The specimen was then indented 0.0625 inch beyond the initial contact point. The assembled jig was immediately placed in a thermally regulated low temperature alcohol bath maintained at the desired test temperature.

Values of S_o were recorded as the sealing pressure necessary to produce a slow air leak at the indentor one minute after placing the jigs in the alcohol bath. Subsequent S_t values were determined after 30 and 60 minutes and also after conditioning the strained specimens at the low temperatures for 94 hours. During periods when no measurements were being made, the assembled jigs and specimens were transferred to and kept in a conditioning cabinet maintained at the desired low temperature. All tests were made in triplicate and the results averaged.

The Sealing Pressure Apparatus is a frequently used and commercially available instrument. It combines the advantages of simple operation and permits a number of tests to be run concurrently, limited only by the conditioning schedule and the number of available jigs. However, it was not designed as a low temperature testing instrument and consequently it poses some operational difficulties.

It was determined that the indentor stem of the Sealing Pressure Apparatus tends to cut into the surface of specimens that are conditioned at low temperatures prior to indentation. The necessity of indenting the specimens at 74°F. to prevent this damage is a severe limitation on the usefulness of the instrument since it results in an inaccurate evalution of stress decay at low temperatures. The readings reflect the cooling and viscoelastic change in hardness of a specimen as well as its stress decay characteristics.

While the Sealing Pressure Apparatus applies a partial compressive strain to a specimen, which is very similar to service conditions, the method of application of this strain imposes two sources of error in the stress decay evaluation. The first error is a consequence of the high friction coefficient of the elastomeric specimen which permits the specimen to rotate with the base of the jig relative to the indentor applying the strain. This results in variable torsional stresses and strains which tend to modify the purely compressive stress decay characteristics. A second error may occur when an indented specimen tends to adhere to the indentor, giving an erroneous air pressure value which may even appear to be a reversal in stress decay (increase in stress). This, in fact, was observed for several of the specimens, which showed an apparent increase in the sealing pressure *(23)*.

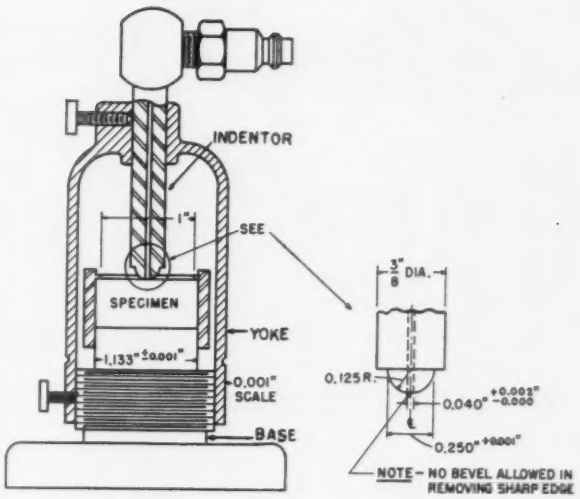

FIG. 9—Schematic diagram of the Sealing Pressure Apparatus.

Results of the Tests

The data obtained with each of the six instruments discussed above have been presented in a series of Material Laboratory reports *(6, 7, 11, 13, 14, 18, 20, 21, 23)*. The stress retention ratios, S_t/S_o, were plotted as a function of the common logarithm of the time after deformation for each of the twelve experimental polymer stocks and for each of the test conditions discussed above.

The stress retention values for one of the experimental Paracril stocks which were to have been determined with the Tensile, Strain Gage, and Cantilever Beam instruments at —35°F. were not available due to increase in stiffness of the stock at this temperature and the inability of these instruments to deform the material to the desired degree under these conditions.

In this discussion, the stress decay curves are presented for only three of the test stocks, which show all of the significant effects noted in all curves for the twelve experimental stocks. For this purpose styrene rubber, Thiokol FA, and neoprene were selected as representative of elastomers having different rheological properties.

The curves are presented in Figures 10 through 18, each of which compares the stress decay characteristics of a given elastomer at a given temperature as determined with the various instruments. The figures to the right of the abbreviated instrument names at 0°F. and —35°F. indicate the length in hours of the preconditioning period.

Each of the curves in Figures 10 through 18 is based on a range of from 8 to 10 points, each of which is an average value of S_t/S_o. The over-all standard deviations (derived from the variance) of these averages for each of the curves are given in Table II. Standard deviations of data obtained with the Sealing Pressure Apparatus are not included because they were determined in a manner that is not directly comparable to the method used in calculating the values in Table II, due to insufficient number of replications.

Statistical analyses of the data obtained with the Hi-Po-Log and Autopneumatic Compression instruments were not made because there were insufficient data. The individual points were omitted from the empirical curves,

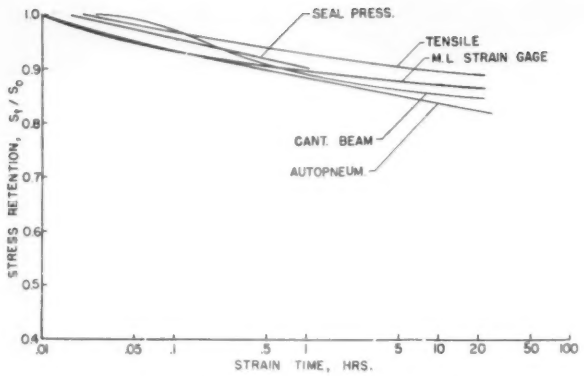

FIG. 10—Stress decay characteristics of styrene rubber, stock E-162-415, at 74°F.

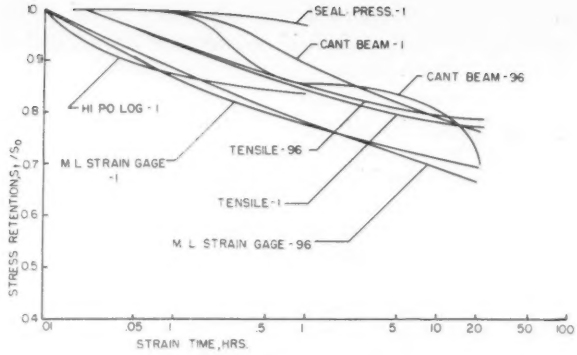

FIG. 11—Stress decay characteristics of styrene rubber, stock E-162-415, at 0°F.

Figures 10 through 18, in order to avoid overlapping. The Cantilever Beam data showed a greater scatter of points about the empirical curves than did the data for the Tensile and Strain Gage instruments.

Conclusions

Interpretation of curves. The curves in Figures 10 through 18 represent decay processes in which the direction of change proceeds toward a reduction of the retained stress ratio, S_t/S_o, with time. The manner of the change at low temperatures is affected primarily by first and second order transition phenomena, and by the rupture and reformation of secondary valence (Van der Waals) bonds *(26)*. Deformation of elastomers in the glassy transition region produces very rapid relaxation of stress as a result of the small range atomic movements which are required to release distortion imposed by the strain *(27)*. Consequently the rate of decay in the glassy region is expected to be most rapid immediately after deformation. On the other hand, when crystallization has occurred to a considerable degree, it results in a rapid decrease of stress toward a zero value after a longer period of time following deformation *(28, 29)*. When present, the effect is most pronounced in the long time region of the experimental curves.

The curves in Figures 10 through 18 show considerable divergence, especially at —35°F. The first cause of divergence is the non-uniformity of methods used due to specific limitations in the apparatuses. As a result, the stress decay characteristics as measured are not strictly comparable.

For example, the curves for the Hi-Po-Log and Sealing Pressure apparatuses are roughly parallel to each other but differ markedly from the other curves at 0°F. and —35°F. These two instruments are the only ones in which the specimens were cooled down to low temperatures after deformation. The lower initial compression modulus of the stocks at the higher initial temperature may account for the different stress decay rates of these curves in comparison with the others *(8)*.

The curves drawn from data for the Cantilever Beam Apparatus show a pronounced divergence from the other curves, which may be attributed to experimental errors, reflecting inaccuracies in the procedure. These differences appear as a theoretically impossible increase in S_t/S_o to a value greater than one, in Figure 14, and as one or more anomalous points of inflection in most of the figures. These points correspond to periods when the test jigs were removed from the compression apparatus and suffered some change in strain in the process of loosening and tightening the jig retaining screws.

The effects of crystallization of neoprene at 0°F. are shown in Figure 17 by data obtained with the Tensile Stress Decay Apparatus. As expected, the specimens exposed for the 96 hour low temperature preconditioning period exhibit a greater degree of crystallization than do

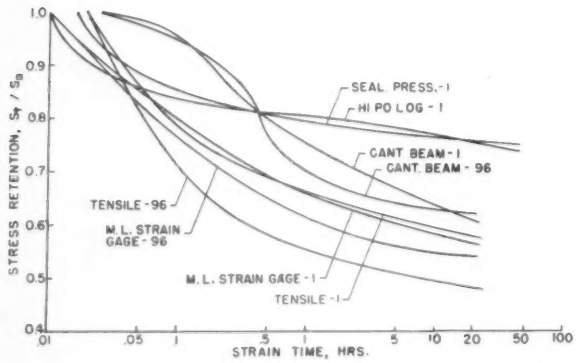

FIG. 12—Stress decay characteristics of styrene rubber, stock E-162-415, at —35°F.

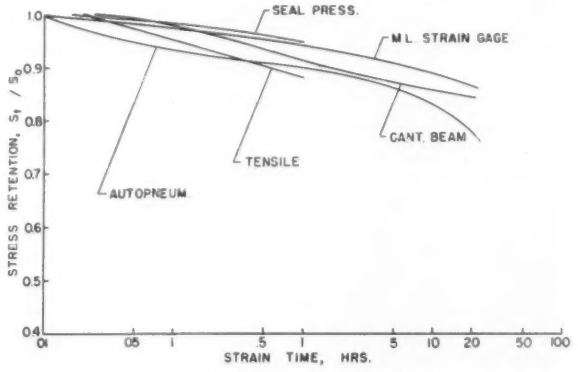

FIG. 13—Stress decay characteristics of Thiokol FA, stock E-53-15, at 74°F.

TABLE II—STANDARD DEVIATIONS OF TRIPLICATE STRESS RETENTION VALUES

Polymer	Stock Number	Temperature, °F.	Preconditioning Time, Hours	Standard Deviation (δ) for data obtained with Tensile Apparatus	Strain Gage Apparatus	Cantilever Beam Apparatus
Styrene rubber	E-162-415	74	1	.0041	*	.0278
		0	1	.0051	.0148	.0246
		—35	1	.0193	.0088	.0547
		0	96	.0067	.0199	.0231
		—35	96	.0412	.0426	.0352
Thiokol FA	E-53-15	74	1	.0024	*	.0154
		0	1	.0112	.0167	.0453
		—35	1	.0323	.0364	.0311
		0	96	.0178	.0203	.0343
		—35	96	.0169	.0251	.0782
Neoprene	E-156-315	74	1	.0049	*	.0134
		0	1	.0113	.0062	.0158
		—35	1	.0405	.0646	.0849
		0	96	.0223	.0408	.0526
		—35	96	.0490	.0298	.0536

* Omitted for statistical reasons due to insufficient number of replications.

the specimens exposed for one hour before strain. This is shown by the earlier indication of crystallization along the log-time axis of the 96 hour curve.

Data in Figure 17 obtained with the Strain Gage and the Cantilever Beam instruments show only a trend toward this effect, and at a much slower rate. The greater sensitivity of the tensile instrument in detecting crystallization may be attributed to the more uniform force distribution provided by the application of tensile strain in the T-50 specimens as opposed to the compressive strain of the other two instruments, as well as to the greater degree of deformation of the specimens.

In general, the curves illustrating data obtained with the Tensile and Strain Gage instruments are very similar. The slight differences in decay characteristics demonstrated by the two instruments may be attributed to differences in the time taken for the initial S_0 measurements or in the more rapid response of the tensile specimens and measuring technique to small temperature fluctuations. Curves of data obtained with the Cantilever Beam instrument show more divergent behavior.

Decreases in conditioning and testing temperatures from 74°F. to —35°F. appear in the experimental curves as increases in the measured rate of stress decay of the styrene rubber, Thiokol, and neoprene stocks as determined with the Tensile, Strain Gage and Cantilever Beam instruments. In Figure 17, this effect is masked by the crystallization phenomenon.

The effects of the pre-strain conditioning period at 0°F. and at —35°F. are demonstrated in Figures 11, 12, 14, 15, 17, 18 and apply to all three polymers considered. Specimens preconditioned for 96 hours and evaluated with the Tensile and Strain Gage instruments show either nearly equal or greater decay than those preconditioned for only one hour. The curves for the Cantilever beam apparatus are too variable to show a particular trend in this respect.

Time of the First Stress Reading. The time, t_0, selected for the first stress reading, S_0, after the initial deformation of an elastomeric specimen, is extremely important in the stress decay determinations made with each of the instruments considered. The directly dependent value of S_0 influences the nature of the entire decay curve since it appears as a common denominator in all of the calculated stress retention values for a specimen under a given set of conditions. Variations in t_0 may affect the decay

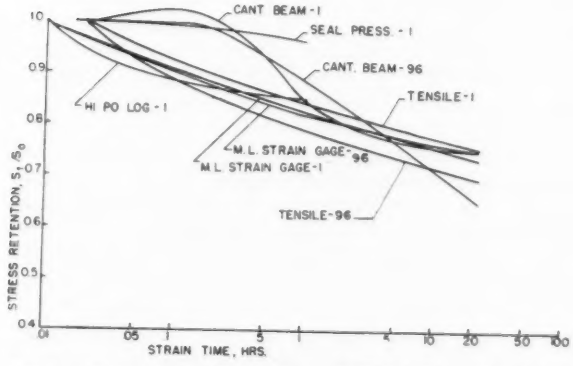

FIG. 14—Stress decay characteristics of Thiokol FA, stock E 53-15, at 0°F.

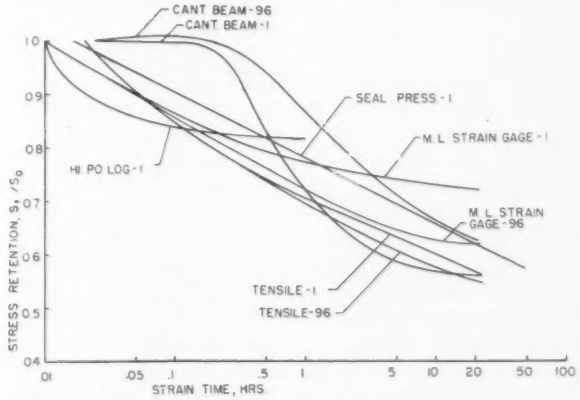

FIG. 15—Stress decay characteristics of Thiokol FA, stock E-53-15, at —35°F.

curves either by displacing them along the log-time axis, or by changing their slopes or apparent rates of decay. Chatten, Scoville, and Conant *(8)* have recognized the importance of variations in t_0 on the stress decay properties of styrene rubber and vinyl stocks.

Change of Strain. It is an unfortnuate characteristic of most "constant strain" stress decay instruments that the initial deformation does not remain exactly constant during the period over which the decay is measured. The process of measuring the stress usually involves some degree of change in the specimen strain. In some instruments, such as the Tensile Stress Decay Apparatus, the strain is decreased by no more than 0.1 per cent of the extended specimen length while making a measurement. After making the stress measurement the specimen is returned to the initial strain more or less accurately.

For other instruments, such as the Material Laboratory Strain Gage Apparatus, where the measurement depends on the deflection of a steel plate, the deflection must change continuously as the specimen stress changes. The specimen strain likewise changes continuously and never returns to its initial value; in fact, the change in strain may vary from 3 to 20 per cent during a set of measurements depending upon the temperature, the polymer, and the recovery of the deflection plate. The Hi-Po-Log instrument suffers similarly.

The Autopneumatic Apparatus produces a change in specimen strain of about 3 per cent at room temperature due to air leakage at the control valve. Thus, in making the stress measurements, all of the instruments show a change in specimen strain varying widely from the ideal condition of no change.

Range of Polymer Application. The instruments discussed in this article are limited in their applicability to various elastomers only insofar as their modulus becomes so high at low temperatures as to prevent deformation of the specimen by the respective loading mechanisms. For example, one of the experimental elastomers, a Paracril 26-NS-90 stock, could not be deformed to the desired degree by either the Tensile, Strain Gage or Cantilever Beam apparatuses after the one hour and 96 hour preconditioning periods at —35°F. *(7, 14, 18).*

Some of the Thiokol specimens offered considerable resistance to tensile deformation at low temperatures. The failure of the instruments to deform specimens at low temperatures is not a serious limitation since the elastomers so affected are probably at temperatures lower than their glass transition temperatures, and no longer suitable for use in elastomeric end items.

Statistical Analysis of Data. The statistical data derived from an analysis of all of the stress decay values for each of the twelve experimental stocks, including the data presented in Table II, were considered in order to determine the reproducibility of results and to compare the relative precision of the stress decay data obtained with the Tensile, Strain Gage, Cantilever Beam, and Sealing Pressure instruments under the various conditions of test. The Hi-Po-Log and Gehman instruments were not considered in the statistical analysis because of insufficient data. Conclusions based on the variances, δ^2, the standard deviations, δ, and on the statistical "F" or variance ratio test are as follows:

(1) In general, the Tensile, Strain Gage and Sealing Pressure instruments show a decrease in precision of data as the temperature is decreased from 74°F. to 0°F. and —35°F., while the Cantilever Beam instrument shows no significant trend in this respect.

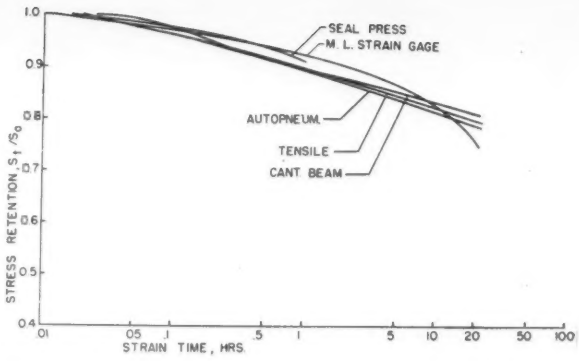

FIG. 16—Stress decay characteristics of neoprene, stock E-156-315, at 74°F.

(2) Data obtained with the Tensile, Strain Gage, and Cantilever Beam instruments do not present sufficient evidence to show a definite relationship between precision of results and the length of the specimen preconditioning period at 0°F. and —35°F.

(3) The reproducibility of data obtained in tests on the neoprene and Paracril stocks used is generally less than that for the Hevea, styrene and butyl rubber and Thiokol FA stocks.

(4) The best reproducibility of stress decay values determined under all of the experimental conditions is shown by the Tensile Stress Decay Apparatus, and the second best by the Material Laboratory Strain Gage Apparatus. The δ^2 values, 0.0004162 and 0.0005330, respectively, are not too different and show the same order of magnitude. The reproducibility of Cantilever Beam data is much worse than that of the above, showing an over-all δ^2 value of 0.0021490, which is greater by one order of magnitude. The reproducibility of Sealing Pressure data is much less than that for the other three instruments. The over-all order of precision shown by the various instruments is therefore Tensile $>$ Strain Gage » Cantilever » Sealing Pressure.

Relative Merit of Instruments. An order of relative merit of the six instruments discussed in this paper has been determined. This order is based on considerations of the design of the respective instruments and their sensitivity to various low temperature elastomeric phenomena, the low temperature performance and ease of operation of the instruments, the type of strain imposed on specimens and the degree of constancy of the maintained strain, the rate of specimen loading, the range of polymer application, the reproducibility of test data, and the nature of the decay curves.

Among the instruments evaluated, the Autopneumatic Compression Apparatus is not suitable for low temperature stress decay measurements in view of serious deficiencies in its specimen loading mechanism.

The Cantilever Beam apparatus is not recommended primarily because of its excessive working space requirements, cumbersome operation, and the nature of its stress curves, which show a systematic difference in the decay characteristics from those exhibited by the other instruments.

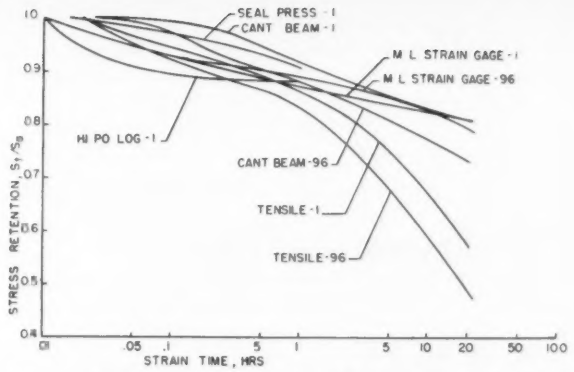
SEAL PRESS - 1
CANT. BEAM - 1
M L STRAIN GAGE - 1
M L STRAIN GAGE - 96
HI PO LOG - 1
CANT BEAM - 96
TENSILE - 1
TENSILE - 96
STRESS RETENTION, S1/S0
STRAIN TIME, HRS

FIG. 17—Stress decay characteristics of neoprene, stock E-156-315, at 0°F.

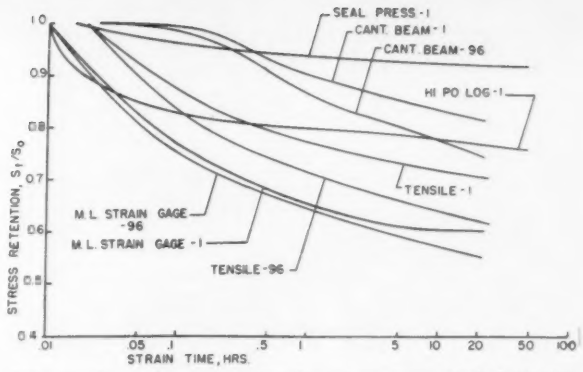
SEAL PRESS - 1
CANT. BEAM - 1
CANT. BEAM - 96
HI PO LOG - 1
TENSILE - 1
M L STRAIN GAGE - 96
M L STRAIN GAGE - 1
TENSILE - 96
STRESS RETENTION, S1/S0
STRAIN TIME, HRS.

FIG. 18—Stress decay characteristics of neoprene, stock E-156-315, at —35°F.

The Sealing Pressure Apparatus is not recommended for low temperature work because of the necessity of indenting a specimen at 74°F. before determining stress changes and because of poor reproducibility of data.

The Hi-Po-Log Apparatus supplied a basis for design of the Material Laboratory Strain Gage Apparatus, which includes some improvements and modifications of the original apparatus. Both the Strain Gage Apparatus and the Tensile Stress Decay Apparatus are considered to be suitable for low temperature evaluation of stress decay properties of elastomers. However, the Tensile apparatus is slightly better because of its more desirable type of measurement, its greater sensitivity to phase changes in the elastomer specimens at low temperatures, and its smaller deviation from constant specimen strain.

Summary

Six instruments for determining stress decay of elastomers were investigated at temperatures of 74°F., 0°F., and —35°F. The results showed that a Tensile Stress Decay Apparatus was superior to the several compression type instruments used. The Material Laboratory Strain Gage Apparatus was found to be the most suitable of the compression type instruments and was considered second choice. The Hi-Po-Log apparatus, a limited version of the Strain Gage apparatus, was ranked third. The Cantilever Beam, Autopneumatic Compression, and Sealing Pressure instruments were found to be unsuitable for use in the determination of stress decay properties of elastomers at low temperatures.

ACKNOWLEDGMENT

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Recent Developments in Compounding Kel-F Elastomers

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Report on a practical polyamine cure utilizing HMDA-Carbamate and use of a high melting fluorocarbon wax as a processing aid

SEVERAL years ago, a research team at the M. W. Kellogg Laboratory set to work investigating the polymerization of a wide variety of fluorinated olefins and diolefins. The primary objective of this project was the development of an oil-resistant arctic rubber for use by the military services. Much of this effort was sponsored by the Research and Development Command of the U. S. Army Quartermaster Corps. At that time, the good low temperature properties and chemical resistance of the crystalline fluorocarbon polymers such as polytetrafluoroethylene and chlorotrifluoroethylene were well known, and it appeared plausible that similar systems containing well defined structural configurations should be elastomeric at room temperature and below. It was soon apparent that copolymerization of many monomers, which when polymerized alone gave crystalline polymers, could yield amorphous rubbers having many unique properties.

One of the most interesting systems studied was the copolymer of chlorotrifluoroethylene and vinylidene fluoride which is a true rubber having high gum strength and the hoped for oil resistance. Kellogg's X-300 rubber, as it was called, did not meet the low temperature requirements for an arctic rubber, however, and so the exploratory program was continued with other systems. At the same time, the decision was made to study the properties of X-300, including means of vulcanization, fabrication and testing of useful end items.

At the ACS Rubber Division meeting in September, 1955, this elastomeric copolymer, now sold under the trademark Kel-F Elastomer, was announced in a series of papers by Honn and others. Since that time, much development work has taken place in the company's laboratories and in those of many of its customers. The following report includes some of the more interesting aspects of this work.

Note: This paper was presented before the Division of Rubber Chemistry, American Chemical Society, at Montreal, Quebec, Canada on May 17, 1957.

Gum Properties

Table I gives data on the gum properties of the two grades of Kel-F Elastomer. They are characterized by the following: (1) Completely saturated molecular chains; (2) High molecular weight; (3) Fluorine content over 50% by weight; (4) No color; (5) Solubility in selected solvents, and (6) Glassy state transition temperatures of 0° C. for Grade 5500 and —15° C. for Grade 3700.

Figure 1 shows the gum in three forms: namely, as a dispersion, a coagulated crumb, and a milled sheet.

The thermal stability of the gum was investigated by measuring the change in solution viscosity after oven aging at various temperatures over long periods of time.

TABLE I—GUM PROPERTIES OF GRADES 3700 AND 5500 KEL-F ELASTOMER

	Grade 3700	Grade 5500
Specific Gravity	1.85	1.85
% Fluorine by weight	50	50
Color	off-white	off-white
Shore A Hardness	45	45
Tg, °C.	—15	0
Embrittlement Temperature, °C.	—64	—51
Bayshore Resilience	5-8	5-8
Torsional Modulus, ASTM D-1053-52T	155-170	155-185
Tensile Properties of Pressed Gum:		
Tensile Strength, psi	350-600	350-600
Per cent Elongation	500-800	500-800
Low Temperature Stiffness, ASTM D-1053-52T:		
Gehman T_2, °C.	—7	+7
T_5	—11	+3
T_{10}	—14	+1
Processibility on the mill at 120°F.	poor	good
Processibility on the mill at 170°F.	good	good

This study showed that temperatures in excess of 450°F. were required to cause chain scission.

As would be expected from a saturated polymer containing C-F bonds, no evidence of unsaturation or autooxidation was noticed following long term exposure to strong UV or outdoor weathering.

Compounding Development

As the rubber has no unsaturation, cross-linking by means of the normal sulfur bridge could not be used, and therefore new methods of vulcanizing were required. Two completely different methods were developed. Advantage was taken of the hydrogen on the chain which in a basic system was abstracted by decomposing organic peroxides generating active sites. Under the proper conditions, these active chains terminated to form C-C linkages. Table II shows a typical recipe for a compound cured by benzoyl peroxide and the resulting physical properties of the vulcanizate. The metal oxides provide the base strength to accelerate the cure. Care must be taken not to introduce any acidic elements (carbon blacks) or any strong organic bases (amines) into the peroxide recipe. Inert fillers such as finely divided silicas, barytes and soft clays may be added without side reactions with the curative taking place.

Another very reactive group is the —Cl which reacts readily with strongly basic, sterically unhindered amines. Aliphatic polyamines were found to be excellent curatives, the main problem being one of control since the reaction is strongly influenced by amine concentration and temperature.

TABLE II—PHYSICAL PROPERTIES OF A KEL-F ELASTOMER VULCANIZATE WITH A BENZOYL PEROXIDE CURE

Kel-F Elastomer Grade	5500	3700
Recipe		
Kel-F Elastomer	100	100
Zinc Oxide	10	10
Dyphos	10	10
Benzoyl Peroxide	3	3
Cure		
Press: hrs./°F.	1/4/300	1/4/300
Oven: hrs./°F.	16/300	16/300
Cure Shrinkage, %	3	4
Physical Properties		
Stress at 300% Elongation, psi	1000	1300
Tensile Strength, psi	2500	3500
Elongation %	425	525
Hardness, Shore A	58	58
Set at Break, %	5	5
Compression Set: 16 hrs. at 158°F., %	35	25
16 hrs. at 300°F., %	40	30
Gehman Stiffness:		
T_2, °C.	+6	—8
T_5, °C.	+3	—12
T_{10}, °C.	0	—14
T_{100}, °C.	—4	—20
Volume Swell, 7 days/77°F., %		
Red Fuming Nitric Acid	26	39
70/30 Iso-octane/toluene	30	14

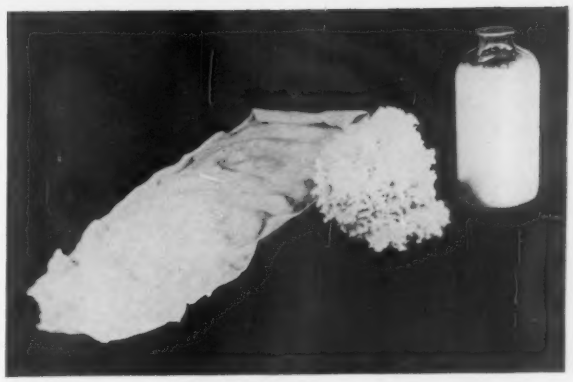

FIG. 1—Kel-F Elastomer gum in three forms: dispersion, coagulated crumb and milled sheet.

Of the various polyamines investigated, such as TETA, TEPA and HMDA, the organic polyamine, hexamethylenediamine, showed the most promise. Amine cured vulcanizates were characterized by high tensile strength, low compression set, and excellent retention of tensile properties after long term aging at 400° F. Metal oxides were needed to moderate the cure and to give better thermal stability. Although the initial reaction is fast, the cure with polyamines was found to require high temperature tempering following the press cure. Such an oven cure minimized the effect of residual amine groups reacting after the molded piece was put in service, and thereby causing serious permanent set.

To utilize the amine cure, improvements had to be made in retarding the initial reaction as the reactive curative was added to the stock. This step has been essentially realized by the use of an inner salt of HMDA, designated HMDA-Carbamate. This salt is a free flowing white powder which is readily soluble in water but insoluble in non-polar solvents. It decomposes readily over a temperature range of 130° to 170° F. to yield the primary diamine, carbon dioxide, and possibly other amino decomposition products.

As noted above, the reaction rate of amines with Kel-F Elastomer varied directly with concentration which, in most cases, was manifested by localized scorch of the gum at the instant the amine was added. HMDA-Carbamate provides the necessary retardation because the salt may be thoroughly mixed with the polymer before the reactive groups are released. This dilution of the active amine groups makes possible easy processing stocks essentially free from scorch.

In using HMDA-Carbamate with Kel-F Elastomer, it is essential that the stock be thoroughly milled at temperatures of 170° to 190° F. after the salt has been mixed into the compound. During this step, the volatile decomposition products escape from the stock. Milling without decomposition would cause their release during the higher temperature press cure, and result in severe blowing of the molded piece. Certain fillers, including carbon black and fine silica, tend to absorb the volatiles released during milling. These volatiles may be desorbed in the press again, giving rise to bubble formation. To prevent such blowing, it is recommended that the HMDA-Carmabate be added to the gum and decomposed prior to the addition of such fillers.

Figure 2 shows the tensile properties of Kel-F Elastomer 3700 as a function of HMDA concentration. The modulus changes directly with amine content, showing the high reactivity of this type of curative. As indicated, approximately two parts of HMDA per hundred of gum gives the best compromise between high modulus and high elongation at break.

Table III shows a typical recipe, curing conditions and the resulting tensile properties for HMDA-Carbamate gum and filled stocks. A wide variety of fillers may be used with the amine cure. These include furnace blacks, thermal blacks, barytes and soft clays. These fillers can be used to increase the hardness and modulus of Kel-F Elastomer stocks, but they have little effect upon ultimate tensile strength. The compression set of even the tightest cured stocks will usually increase with filler loading. These effects are shown in the table.

There is strong evidence that HMDA-Carbamate can be used to good advantage with other elastomers. It is well known that polyamines can cure neoprene, but practical cures are generally unsuccessful due to premature reactions with attendant scorch. Preliminary tests with HMDA-Carbamate and Neoprene WRT look promising.

Similar results were obtained with Hycar Acrylic Rubber 4021 in which Altax and HMDA-Carbamate were used to retard the fast reacting polyamines. Some of the very new elastomers, such as the copolymer of perfluoropropene and vinylidene fluoride now being studied by Minnesota Mining and Manufacturing Co. and the Quartermaster Corps as Kel-F Brand Elastomer 2140, and by DuPont as Viton A, can be cured with HMDA-Carbamate to give high strength vulcanizates with exceptionally low compression set and resistance to a wide variety of chemicals.

Special Processing Aid

Another recent development is the use of a high melting fluorocarbon wax sold under the trademark Kel-F 200 which acts as a procesing aid for Kel-F Elastomer during fabrication. Kel-F 200 wax is a low molecular weight polymer of chlorotrifluoroethylene having the general formula:

$$Cl—(CF_2—CFCl)_n—Cl$$

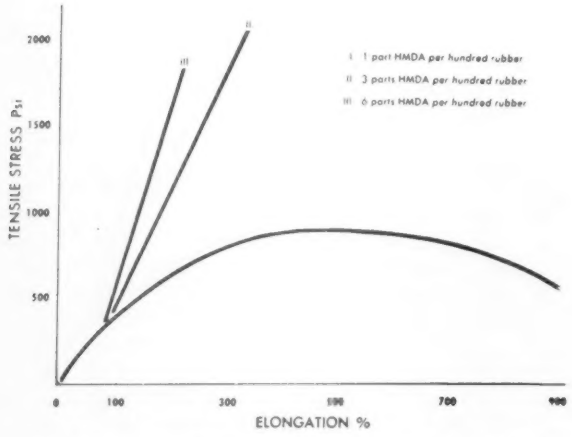

FIG. 2—Effects on tensile properties of Kel-F Elastomer by hexamethylene diamene vulcanization.

TABLE III—PHYSICAL PROPERTIES OF A KEL-F ELASTOMER STOCK VULCANIZED WITH HMDA-CARBAMATE

Cure: Press, ½ hour at 300°F.; oven, 16 hours at 300°F.

Recipe	
Kel-F Elastomer 3700	100
Zinc oxide	10
Dyphos	10
HMDA-Carbamate	3
Physical Properties	
Stress at 100% elongation, psi	1000
Tensile strength, psi	2100
Elongation, %	325
Hardness, Shore A	56
Tear strength, ppi	150
Compression set, % (70 hours at 300°F.)	45

The general properties of this heat stable wax are: softening point, 210° F.; specific gravity, 68°/39° F., 2.11; upper limit of thermal stability, 400° F.; moisture absorption, 0. It is chemically stable to all oxidants including fuming nitric acid, liquid oxygen and 90 per cent hydrogen peroxide. The wax is slightly soluble in aromatic hydrocarbons, chlorinated hydrocarbons, ketones, esters and fluorocarbon oils.

The high molecular weight and correspondingly high viscosity of Kel-F Elastomer 3700 has been the cause for many processing problems, particularly in those cases where a compounded stock is required to flow into a complex mold cavity or through a narrow die. This elastomer's resistance to flow often results in incompletely filled cavities, scorched stocks and surface distortion. The addition of Kel-F 200 wax in amounts of 15 to 20 parts per hundred of rubber minimizes many of these ill effects. Its advantages include the following:

(1) It is completely soluble in Kel-F Elastomer gum, i. e., the polymers may be readily mixed on a mill. There is no apparent bleeding or separation of wax from gum once the materials have been well mixed.

(2) The high softening point of Kel-F 200 wax, 210° F., allows it to melt and plasticize the long chain rubber molecules at the molding temperatures normally recommended for Kel-F Elastomer. The wax-containing rubber stocks flow more readily into mold cavities or through extrusion dies. Upon cooling, the wax hardens and gives the stock the dimensional stability required for easy removal from molds without distortion. The wax does not plasticize or stiffen the stock at room temperature and, therefore, no marked change in flexibility at room temperature or below is observed. The presence of 15 to 20 parts of wax per 100 parts of Kel-F Elastomer does impart some tackiness to the uncured compound, resulting in better knitting of parted stocks.

(3) The over-all chemical and thermal stability of Kel-F 200 wax allows its use in Kel-F Elastomer stocks without detracting from the excellent chemical resistance and high temperature stability of the elastomer.

Figure 3 shows two diaphragms molded from Kel-F Elastomer 3700 in identically the same manner. The diaphragm on the left was molded from an amine stock containing 15 parts of Kel-F 200 wax, while that on

the right was molded from the same basic compound without wax. Kel-F 200 wax can be used in both peroxide or amine containing compounds without causing side reactions with the curative.

Although the use of Kel-F 200 wax with Kel-F Elastomer 3700 results in a marked improvement in processability during molding, one should not conclude that such a stock can be molded as easily in all types of complex molds as can some of the very low viscosity gums such as the silicones. Care must still be exercised in selecting the size and shape of the preform and in the design of the mold to prevent hold-up at narrow channels, resulting in excessive pressures, incompletely filled mold cavities, and highly-oriented molded pieces.

Properties of the Vulcanizates

Listed below is a summary of the principal properties of Kel-F Elastomer vulcanizates which have guided many in its applications to date. It has, like all materials, certain limitations and these must be recognized by the materials engineer. Its vulcanizates have the following characteristics:

Tensile Strength. Kel-F Elastomer possesses high tensile strength and abrasion resistance. Much of its strength is developed under stress due to crystalline forces. At elevated temperatures, these forces are dissipated with an attendant reduction in modulus and tensile strength.

Thermal Stability. Kel-F Elastomer vulcanizates have aged 60 to 80 days at 400° F. without losing more than 25% of their tensile strength and elongation and with no appreciable increase in hardness.

Low Temperature Stiffness. The high degree of stiffness developed at its corresponding Tg value (0 to —15°C.) is a detriment to this material's application. Yet thin films have been flexed and seals successfully tested as low as —50° C. without embrittlement failure.

Chemical Resistance. Kel-F Elastomer 5500 compounded with Kel-F 800 Resin has withstood attack from the most powerful oxidants now in use. Long service has been attained in contact with fuming nitric acid propellants, oleum, 90% hydrogen peroxide, phosphoric and nitric acid anodizing solutions and liquid oxygen. For the best service in such oxidants, thermoplastic blends of rubber and resin are preferred. Where vulcanization is required, the peroxide cure is more stable. The hot oil resistance of both grades 3700 and 5500 is excellent, with the former having somewhat better resistance to swell. The oils tested include ASTM No. 3, Swan Finch transmission oil, sour crudes, MIL-O-5606 and OS-45 aircraft lubes, Pyranol transformer oil and silicone oils. Kel-F Elastomers 3700 and 5500 swell excessively in aircraft diester oils.

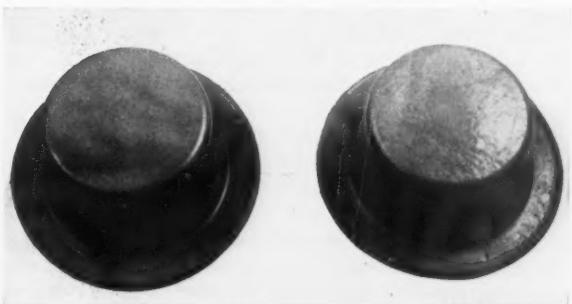

FIG. 3—Two diaphragms molded from Kel-F Elastomer 3700, the one on the left containing 15 parts Kel-F 200 wax and the other no wax.

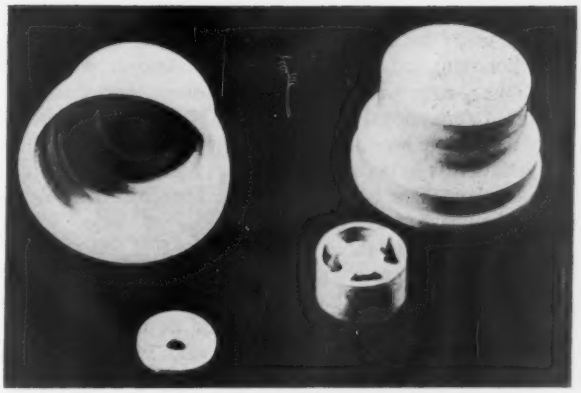

FIG. 4—Typical compression molded seals and diaphragms made with Kel-F Elastomer. These were molded by Vernay Laboratories.

Applications of the Elastomer

The fabrication of Kel-F Elastomer into useful end items has been under development both in the company's laboratory and in those of its customers. Both grades have been compression molded into a wide variety of complex seals, diaphragms, pump liners and O-rings. Examples of compression molded seals and diaphragms are shown in Figure 4. These were molded by Vernay Laboratories, Yellow Springs, Ohio to very fine tolerances.

Grade 5500, by virtue of its lower viscosity, is easier to mold, although the use of Kel-F 200 wax offers more latitude in molding 3700. Both grades have been extruded into high quality tubing. Grade 5500 has been calendered to thickness of 0.002 to 0.005 inch over Dacron fabric. In the field of sealants, 5500 has been compounded into a filleting material for use in sealing off integral fuel tanks on aircraft.

Described below are two specific examples where molded Kel-F Elastomer parts are in use and doing an excellent job.

Figure 5 shows the cut-away section of the Vanton chemical pump, which consists of a rigid body or stator and a flexible sleeve or liner flanged to the body. These flanges are pressed to the body block eliminating shaft seals and stuffing boxes. The fluid to be pumped is trapped between the outside of the flexible liner and the inside of the body block. Pumping is accomplished by an eccentric shaft upon which is mounted the rotor. The rotor, when rotating, pushes out on the flexible liner to create a progressive suction and discharge pressure on the fluid trapped between the liner and housing.

The Vanton Pump and Equipment Corp. uses a variety of plastic body blocks and rubber liners, each specified to handle certain chemicals. The Kel-F Elastomer liner has found numerous applications. These include pumping sulfuric acid, hydrochloric acid, oleum, titanium tetrachloride, and red fuming nitric acid. Very

satisfactory service has been reported from several companies using this liner for handling titanium tetrachloride. On handling red fuming nitric acid, one report stated that the pump with a Kel-F Elastomer liner has been running continuously for 14,700,000 flex cycles without any noticeable swelling or corrosion. Success in such an application is in no small way due to the precision molding of the rather complex flexible liner by the Chicago Rawhide Manufacturing Co.

Another application in which Kel-F Elastomer has been used to good advantage is a seal in a unique electrolytic capacitor produced by the Fansteel Metallurgical Corp., Chicago, Ill. This capacitor develops the highest capacity per unit area and, in addition, is the most stable dielectric, chemically and electrically, yet developed.

Figure 6 shows the essential parts of the porous tantalum capacitor. To maintain high capacitance and low dc leakage over a broad temperature range, great pains are taken to ensure the purity of the oxidized tantalum film, the silver cathode, and the contained electrolyte. To maintain high purity, the anode is permanently sealed into the silver case by the insulator and seal, as shown.

For operation at —55° C. to +85° C., butyl rubber seals have been used with good results. As often happens, it became necessary to extend the operating temperature of many electronic parts to meet high temperature environments. After an extensive study of insulating materials, Kel-F Elastomer was selected as having the best combination of properties for this application. These properties include: (1) The resilience required for effecting a permanent and hermetic seal; (2) Good dielectric properties such as high insulation resistance; (3) Thermal stability, and (4) Chemical inertness to the electrolyte even at high temperatures.

Recognition must be given to the Vernay Laboratories, Yellow Springs, Ohio for their work in developing satisfactory peroxide cured stocks, and in molding large quantities of Kel-F Elastomer seals to the close tolerances required in this application. By improvements in the seal, the Fansteel HP Series Capacitor can now be used at much higher temperatures than heretofore. This example again shows where a specialty material commanding a high cost can be utilized to good advantage.

FIG. 5—Cut-away section of the Vanton chemical pump. Use of a Kel-F Elastomer liner has increased the number of chemicals it can handle. The arrows indicate fluid passage.

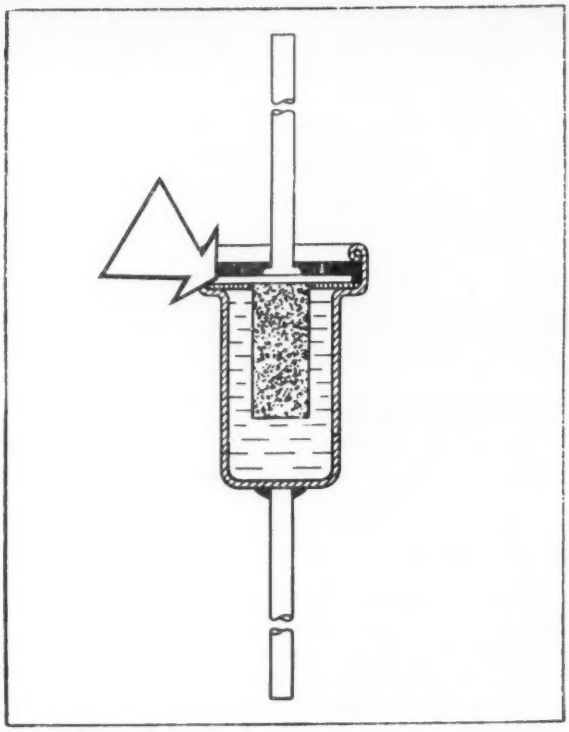

FIG. 6—The anode of the Fansteel capacitor is permanently sealed into the silver case by the insulator and seal (arrow).

Summary

Kel-F Elastomer, Minnesota Mining & Manufacturing Co.'s copolymer of chlorotrifluoroethylene and vinylidene fluoride, is a fully saturated fluorocarbon rubber characterized by its high strength, thermal stability, and chemical resistance to powerful oxidizing agents and a wide variety of hot oils. Recent developments of the elastomer include a practical polyamine cure utilizing HMDA-Carbamate in which re tardation of the highly reactive amine groups has been achieved; and a processing aid in Kel-F 200 wax, a high melting fluorocarbon wax, which improves the flow characteristics of the viscous gum.

To be more applicable, Kel-F Elastomer requires improvement in low temperature properties and in processibility. Development work to achieve these objectives is in progress.

A variety of specialty applications for Kel-F Elastomer is under development. There is no doubt that such specialty rubbers are growing in importance as the requirements of the military services and industry become more and more difficult to meet.

Function of

Rosins and Rosin Derivatives in Pressure-Sensitive Adhesives

By FRANK H. WETZEL

Hercules Research Center, Hercules Powder Co., Wilmington, Del.

ROSIN and rosin derivatives have long found considerable use as tackifiers in adhesives in combination with rubbery-type polymers. To understand better the function of these materials in adhesives, research tools were developed to measure objectively certain adhesive properties. Analysis of pressure-sensitive adhesion has indicated that three properties are of basic importance —tack, internal strength and viscosity. Of these, tack appears to be the most important and may be closely interrelated to viscoelastic deformation.

Pressure-sensitive tack data given in this paper were determined by the Hercules Tack Test, which had been developed earlier. Tack was studied as a function of concentration of various rosin-based tackifiers in unvulcanized natural rubber.

The tack of unvulcanized natural rubber was found to be unchanged by the addition of 20 to 40 per cent resin tackifier. Further addition of tackifier caused a rapid increase in tack to a sharp maximum, after which tack decreased to zero. Maxima in tack occur at 50 to 75 per cent resin tackifier.

The flow characteristics of the tackifier influence (1) the concentration of tackifier at which tack initially increases over that of rubber alone, and (2) the concentration of tackifier at which maximum tack is obtained as well as the magnitude of tack at this concentration. The necessity of a two-phase system for multicomponent pressure-sensitive adhesives is suggested, and the structural specificity of rosin-based tackifiers is discussed.

ROSIN and rosin derivatives have long found considerable use as tackifiers in adhesives in combination with rubbery-type polymers. The over-all good compatibility, attractive economic aspects, and contribution to adhesion of rosin and modified rosins have been responsible for the continued consumption of these products by the adhesives industry.

To understand better the function of rosin or rosin derivatives in adhesives, research tools were developed to measure objectively certain adhesive properties. Pressure-sensitive adhesives were chosen as a starting point with the hope that once an understanding of this system was gained, the findings would be roughly applicable to solvent and latex systems, and that further, the pressure-sensitive adhesive techniques would apply with some modification to solvent and latex systems.

Pressure-sensitive adhesives and solvent and latex cements represent the major portion of adhesives containing unvulcanized elastomers. Such adhesives are usually composed of an elastomer and a resin tackifier plus various modifiers, such as fillers, plasticizers and stabilizers. Any adhesive must intimately contact the substrate (or adherend) to which it is to be adhered. Such contact is generally recognized to be necessarily on a molecular scale to bring into play the dispersion, residual valency, or polar effects that are responsible for adhesion *(1)*.

In pressure-sensitive adhesives, no solvent is present to make the adhesive sufficiently fluid when applied to a substrate so as to effect intimate contact between the adhesive and the adherend. The adhesive mass itself must both wet the substrate and deform at the interface to contact the adherend intimately. This requires a relatively low modulus of elasticity as well as short relaxation times to relieve internal stresses. However, the soft, rubbery systems which possess the properties necessary to effect the above are also susceptible to long-time viscous flow. Under static loads to which they are subjected in use, these adhesives flow sufficiently to cause bond failure ultimately.

A different situation exists in solvent cements and, to a degree, in latex cements. Solvent cements usually contain relatively non-tacky adhesive masses, including elastomers other than natural rubber, which often are not tacky either to themselves or to other adherends. Moreover, most solvent cements are designed to give considerably greater strengths than pressure-sensitive adhesives.

This is accomplished by means of higher molecular weight tackifiers which lend cohesive strength at the expense of adhesive tack or by the use of tackifiers at considerably lower levels than are used in pressure-sensitive adhesives. Large concentrations of filler will also in-

Note: This paper was presented before the American Chemical Society, Miami, Florida, April, 1957.

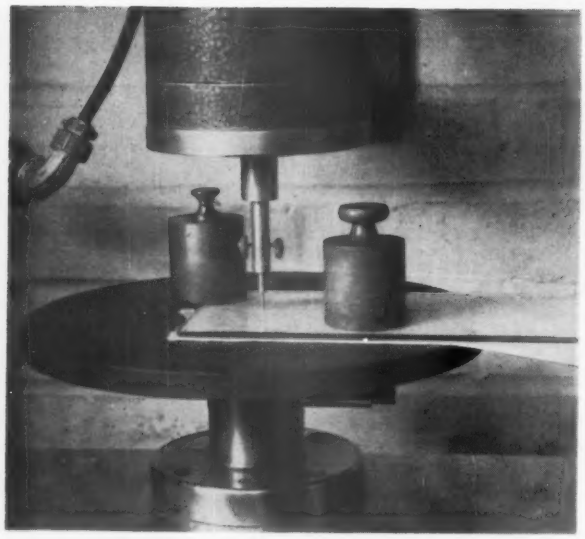

FIG. 1—Closeup view of brass probe in piston-type holder as used in determining tack.

crease the strength, but at the sacrifice of tack. Therefore, the medium—whether it be an organic liquid for a solvent cement or water for a latex cement—must aid the adhesive mass in making suitable contact with the adherend and, in the last stages of solvent evaporation, act as a plasticizer to gain maximum contact between adhesive and adherend.

The latter function is especially important in cements containing elastomers like some types of neoprene which crystallize and stiffen. This general picture is somewhat further complicated in the case of latex cements, which ordinarily require heat or pressure to force the disperse adhesive particles to coalesce and form a continuous film of adhesive.

Experimental Methods

Analysis of pressure-sensitive adhesion indicated that three properties are of basic importance—tack, internal strength and viscosity. Of these three properties, tack appears to be the most important. Inherent in the measurement of tack is not only nearly instantaneous adhesion, but also the ability of an adhesive to undergo viscoelastic deformation. A study of the latter could lead to an understanding of the interrelationship between tack and viscoelasticity.

Tack may be defined for adhesive purposes as the property of a material which enables it to form a bond of measureable strength immediately upon contact with another surface *(2,3,4)*. For pressure-sensitive adhesives, tack may be measured as the force required to separate an adherend and an adhesive at the interface shortly after they have been brought rapidly into contact under a light load of short duration. The fundamental assumptions made in this definition of tack as well as a thorough discussion of the method and variables have been discussed in a previous paper *(2)*. Only a very brief discussion of experimental technique will be given here.

A polished, brass probe was held in a free-sliding piston-type probe holder which determined the load on the probe, as seen in Figure 1. The probe slid within an aluminum pipe which was rigidly attached to a load cell (Figure 2). A glass supported pressure-sensitive adhesive film was placed on the crosshead of the Instron Tensile Testing Machine. The film approached and contacted the probe at a rate of 20 inches per minute. After a contact time between probe and film of exactly one second, the film was moved away from the probe at 20 inches per minute. The stress required to break the bond, recorded by means of the load cell and a high-speed recorder, was the tack. The time required to separate the probe and film was approximately one-hundredth of a second.

Several variables in the measurement of tack have been thoroughly investigated. A substitution in material of which the probe is constructed changed the absolute but not the relative tack. The probe surfaces were metallographically polished to present as smooth and reproducible a surface as possible. Both the rate of make and break of the bond were critical, as was the duration of contact between probe and adhesive. Source of variance was avoided by use of a constant crosshead rate (20 inches per minute) and use of a one second ($\pm$ 5%) contact time.

With regard to sample preparation, the adhesive masses were solvent cast from toluene and allowed to dry 10 to 20 hours until solvent-free *(2)*. Statistical analysis of experimental data indicated that good reproducibility was obtained as long as solution preparation, film preparation, preparation of substrates, drying times of solvent-cast films, and the times of ambient aging before tests were reasonably reproduced from day to day.

The reproducibility of tack data from accelerated aging of the adhesive mass, however, was found to be extremely sensitive to the aging conditions and to the length of time elapsing after accelerated aging was stopped but before testing for tack. It was especially important that the time elapsing between the end of accelerated aging and testing for tack be as short as possible and be reproduced from day to day.

Discussion of Results

Tack, as a function of composition, was studied in a simplified system which consisted only of a resin tackifier in unvulcanized natural rubber. The use of additives such as fillers, plasticizers, and stabilizers was intentionally avoided. Consequently, any adhesive properties obtained for an aged or unaged resin-rubber system could be ascribed solely to the resin tackifier being studied.

Unaged Adhesive Results. No increase in tack over that of rubber was detected at concentrations of less than 20 to 40 per cent of tackifying resin. Thereafter, the tack increased quite rapidly to a maximum. In the case of the high- and intermediate-softening resins, after maximum tack had been reached, tack decreased rapidly to zero as tackifier concentration increased.

For low-softening resins, however, "legging" prevented the measurement of tack at resin concentrations above 70% but below 83%. "Legging" is the pulling of strings of adhesive out of the adhesive mass, and is presumably caused by the inability of the adhesive to undergo rapid deformations and retractions. This violates one of the

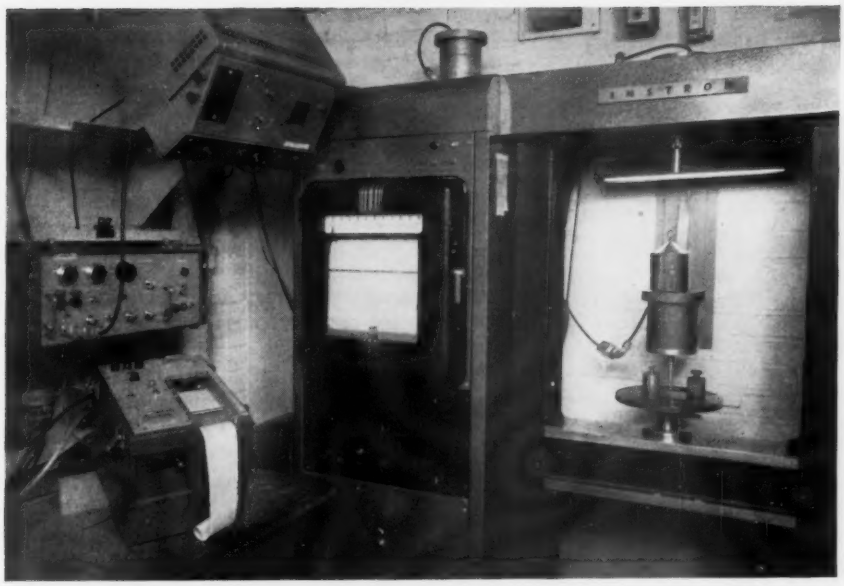

FIG. 2—Set-up of the Instron Tensile Testing Machine and the Sanborn Recorder as they were arranged for the Hercules Tack Test, which was used in determining the experimental data used in this study.

experimental assumptions. We, therefore, could not measure the maximum tack obtainable. Typical tack versus concentration curves are shown in Figures 3 and 4.

The resinous tackifiers studied do not readily lend themselves to a classical melting point. On the contrary, the characteristic physical property which is most easily measured is a softening point *(5)* and this is, in truth, a viscosity measurement. The shape of the tack versus composition curve was generally similar for all resins studied. The concentration of tackifier in natural rubber at which maximum tack was obtained varies from 50 to >75 per cent and correlates inversely with the softening point or viscosity of the resin. The higher the softening point, the lower the per cent resin at which maximum tack was obtained. Moreover, resins of lower softening point provided greater obtainable tack, but at a higher concentration.

Results of Accelerated Aging. A variety of resins were aged in resin-natural rubber formulations. Accelerated aging was carried out to compare stabilities of tackifying resins in an elastomer. In order to avoid concentration effects of the resin, aging was effected at the same concentration for all resins, that is, a composition of 3:2 resin: rubber. This concentration represented a compromise between the optimum values for intermediate- and high-softening resins.

Accelerated heat aging was carried out in a forced draft oven at 200°F. This probably caused an acceleration largely in oxidation. The temperature was defined so that aging occurred at a rate that was conveniently rapid and yet could be experimentally followed.

Aging under the effect of ultraviolet (U. V.) radiation was accomplished by means of a germicidal U. V. bulb. The aging box was vented so as to avoid build-up of ozone concentration.

Typical aging curves are shown in Figure 5 for 3:2 Pentalyn H-rubber (Pentalyn H is the pentaerythritol ester of hydrogenated rosin). In both U. V.-aging and heat-aging, tack was unaffected to a point but then decreased rapidly.

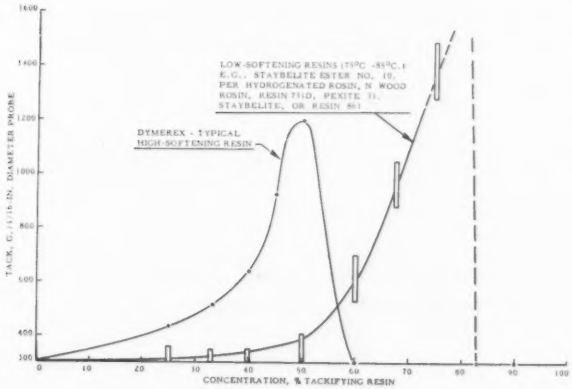

FIG. 3—Tack versus concentration of tackifying resin in natural rubber for high- and low-softening resins (unaged).

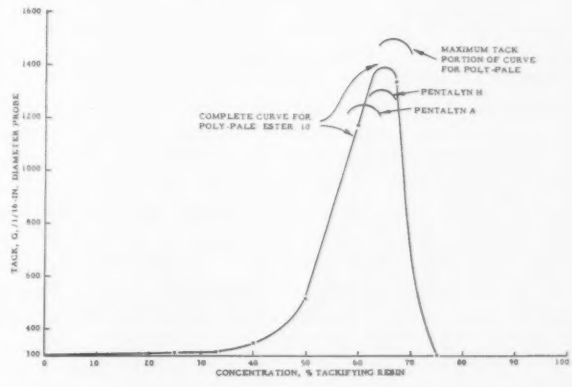
MAXIMUM TACK PORTION OF CURVE FOR POLY-PALE
PENTALYN H
PENTALYN A
COMPLETE CURVE FOR POLY-PALE ESTER 10
CONCENTRATION, % TACKIFYING RESIN

FIG. 4—Tack versus concentration of tackifying resin in natural rubber for intermediate-softening resins (unaged).

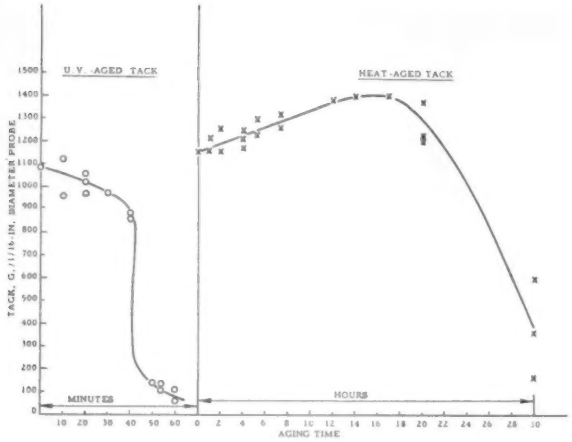

FIG. 5—Tack of 3:2 Pentalyn H-rubber as a function of accelerated aging under ultraviolet and heat (200°F.).

Conclusions

As the tackifier concentration is increased in unvulcanized rubber in unaged films, no change in tack from that of rubber alone is observed until a tackifier concentration of 20 to 40 per cent has been reached. As will be subsequently shown in an article by C. W. Hock and A. N. Abbott *(6)* rubber appears to be saturated with tackifier at this point and a second phase probably is formed. Presumably, once the concentration of tackifier in rubber is such that the rubber is saturated, an increase in tack over that of rubber alone is obtained.

The variation from resin to resin in causing an increase in tack over that of rubber alone might be explained on the basis of softening point (viscosity) and molecular association of resin molecules. The harder or higher-softening resins are either more associated or are composed of larger molecules than the softer or lower-softening resins. The harder the resin is, the less it will dissolve in rubber because of appreciably fewer points of contact between resin and rubber. The rubber is saturated with such harder resins at lower concentrations than with softer resins. Therefore, any increase in tack over that of rubber alone by addition of resin will occur at a lower concentration for the higher softening resins.

Similarly, the resin concentration at which maximum tack is obtained and the maximum tack obtainable are a function of the softening point characteristics of the tackifying resin. (Experimental data are given in the accompanying table.) Tack presumably is more responsive to the disperse or second phase (mostly resin plus low molecular weight rubber) than to the original, continuous phase (rubber saturated with resin). Increasing the concentration of resin increases the amount of disperse phase and will result in an increase in tack only as long as some rubber continues to dissolve in this phase and the ease of deformation of this phase increases.

As discussed above, the resins of lower softening point dissolve to a greater extent in rubber in the continuous phase than do the higher softening resins. By the same token, low ends of rubber will continue to dissolve in the lower softening resins in the disperse phase as resin concentration increases. This makes the latter phase more deformable at higher resin concentrations than when harder resins are used. Therefore, increasing the concentration of soft resins in the gross adhesive mass will increase the ease of deformation and the tack at much higher concentrations. Moreover, the soft resins will ultimately contribute more deformability and more tack than a hard resin.

At maximum tack, presumably the maximum amount of low ends of rubber has dissolved in the disperse, resin phase. Further increase in resin concentration apparently results in the disperse, resin phase increasing in brittleness, and perhaps a phase inversion occurs. In any event, the gross adhesive mass becomes considerably less viscoelastic and tack decreases.

Assuming the necessity of a two-phase system for tack, aging in general presumably causes intrinsic changes that lead back to a one-phase system. Films aged to zero tack have been found to be one-phase *(6)*. We believe that during aging the elastomer apparently decreases sufficiently in molecular weight to make resin and rubber completely compatible in the molecular sense, and adhesion is then no longer possible. Preliminary data indicate that adhesives aged to the point of zero tack contain rubber that has decreased nearly 75 per cent in molecular weight and is completely alcohol-soluble.

A generalization concerning the specificity of the large rigid structure presented by rosin or modified rosin may be made for use of these materials as tackifying resins. On the basis of association between elastomer and tackifier, presumably a resin is compatible with an elastomer due to the same association phenomena that are responsible for solutions. There are many esters and acids that certainly present as many points of contact between elastomer and tackifying resin as do the rosin derivatives.

The vast majority of the acids and esters, other than those that are rosin-based, however, have a tendency either to crystallize or exude. These, therefore, are not compatible with the elastomeric systems generally used in adhesives. Presumably, the large rosin molecule allows many points of contact, thus contributing to this compatibility between the large resin molecule and the elastomer. Moreover, the natural rosin-based tackifier

RELATION OF SOFTENING POINT OF TACKIFYING RESIN TO CONCENTRATION GIVING MAXIMUM TACK AND MAXIMUM TACK OBTAINABLE

Tackifier	Softening Point °C.	Resin at Which Maximum Tack Is Obtained, %	Tack at Maximum Level, g.
Dymerex	150	50	1200
Pentalyn A	111–114	61	1250
Poly-pale Ester 10	110	65	1360
Pentalyn H	105	65	1300
Poly-pale	101	67	1500
Staybelite Ester 10	80–85	>75	>1600
Perhydrogenated Rosin	80–82	>75	>1600
N-Wood Rosin	83	>75	>1600
Resin 731D	81	>75	>1600
Pexite 31	81	>75	>1600
Staybelite	76	>75	>1600
Resin 861	74	>75	>1600

will not crystallize. The molecule appears to be sufficiently large so that its lack of mobility will not lead to concentration of the tackifier in local areas and thus cause exudation.

This picture is, however, quite complex. Abietic acid, when used alone with unvulcanized rubber, crystallizes very rapidly and is useless as a tackifying resin. Dihydroabietic and dehydroabietic acids behave in the same manner. Furthermore, combinations of any two of these also crystallize. But, when all three acids are combined, the combination appears to be completely compatible with natural rubber, will not crystallize, and does indeed lend an appreciable increase in tack over that of rubber by itself.

This level of tack, however, is considerably less than that found in a natural rosin, bearing, as its chief components, all three of these acids. Therefore, there seems to be a certain synergistic effect of these various structures which is necessary for compatibility and contribution to adhesion. What other trace elements occurring in the natural product of rosin are necessary to contribute to adhesion in an elastomeric system awaits definition.

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(4) Gainsley, M., and Dow, J., in "Adhesion and Adhesives: Fundamentals and Practice," John Wiley & Sons, Inc., New York, 1954, pp. 127-29.

(5) Hercules Powder Co., "Hercules Drop Softening Point Method," Form No. 400-431-C (1955).

(6) Hock, Charles W., and Abbott, Albert N., "Topography of Pressure-Sensitive Adhesive Films," *Rubber Age*, to be published in Vol. 82, No. 3 (December, 1957).

Molds Custom-Cast Directly from Original Models

THE "Accu-Cast" method of precision casting mold and die components has been introduced by Manco Products, Inc., 2401 Schaefer Road, Melvindale, Mich. The molds are made directly from expendable original patterns which may be of any of a number of materials, including almost any castable metal, with no need for costly and time-consuming machining of steel master dies.

Typical applications of the process include making molds for forming rubber and glass and for compression and injection molding of plastics, as well as extrusion dies and die inserts for die casting. Properties claimed for the components made by the process include a wide range of sizes, availability of thin sections, predictable shrinkage, dense grain structure, superior surface finish, long service life and resistance to heat and abrasion.

Coming Next Month...

Effect of Gamma Radiation on Heat Resistant Elastomers—By Robert Harrington, Hanford Laboratories Operation, General Electric Co., Richland, Wash.

Part II of the series on "Elastomers for Use in Radiation Fields" gives data on physical property changes of silicone, fluoroelastomer and isocyanate-urethane elastomers caused by the effects of gamma radiation.

Rubber-to-Metal Adhesion: A Symposium

Five speakers at the October 25 meeting of the Akron Rubber Group surveyed the field of rubber-to-metal bonding; their addresses will be presented in full.

Topography of Pressure-Sensitive Adhesive Films—By Charles W. Hock and Albert N. Abbott, Hercules Research Center, Hercules Powder Co., Wilmington, Del.

A study of the relation between surface configuration and the qualities necessary for good adhesion.

Automatic Spray Painting of Rubber Covered Athletic Balls.

How the Spalding sports goods company has reduced the cost of finishing its rubber covered equipment by 40 per cent.

A Uni-Rotor Mixer for Rubber and Plastics

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A machine based on a new concept of the mixing operation offers advantages both in cost and efficiency

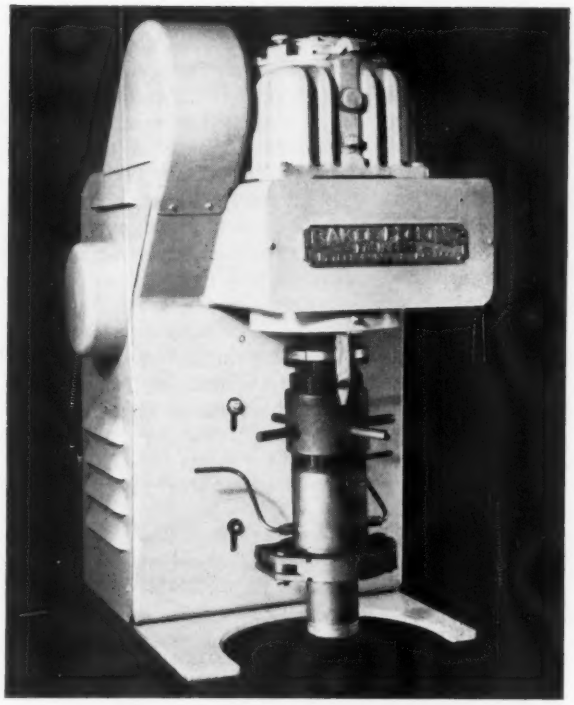


FIG. 2—Over-all view of the Uni-Rotor Mixer.

INTERNAL mixers for rubbers and plastics as a rule employ horizontal twin rotors, and often a ram for directing material between the rotors. Equipment based on this mixing principle has some disadvantages from both the engineering and operational aspects, such as uneven torque during mixing and the difficulty of adequately preventing escape of material and interchange contamination at the shaft sealing glands.

FIG. 1—Mixing in the Uni-Rotor is achieved in a chamber (right) by a twisted blade (left) which fits concentrically into the chamber.

An alternative mixing principle which has certain attractive features is a single vertical rotor concentric in a chamber, rotor and chamber wall being designed to impart both lateral and downward motion to the material to achieve mixing with no losses from the open top of the chamber.

It was convenient first to test such uni-rotor mixing on a laboratory-scale machine. Further, a laboratory mixer fulfills a practical need, since limitations of reduction in size, temperature control, loss of material, advent of impurities and the presence of atmospheric gases make small-scale versions of two-rotor mixers inadequate for precise laboratory experimentation. The mixer described herein has been in regular use in the laboratories of the British Rubber Producers' Research Association for several years, and has come to be regarded as routine equipment for small-scale mixing operations.

Description of the Uni-Rotor Mixer

The rubber or plastic and compounding ingredients are contained in a generally cylindrical or slightly conical chamber, and are mixed by the rotation of a twisted blade inserted concentrically in the chamber. Figure 1 shows the rotor and chamber component, and Figure 2 the entire machine.

With the correct direction of rotation, the opposing

helices of the rotor and the chamber wall induce material to move to the closed end of the chamber, with a compensating upward circulation elsewhere. Because of the downward urging of material, there is no need for a ram and no tendency for matter to escape although the chamber is not closed at the top. The material is also periodically squeezed between the rotor edges and the groove ridges in the chamber, an even number of grooves giving equal thrusts on both edges of the rotor. The resultant complex motion has been found to produce efficient mixing.

The construction of the apparatus, diagrammed in Figure 3, rigidly holds the chamber concentric with the rotor at a selected depth of insertion, and provides drive to the rotor. The shaft, Sh, can be rotated at 11 to 90 rpm by a one hp 1440 rpm motor acting through an infinitely-variable speed vee-belt drive and a worm reduction gear.

The shaft is supported within its sleeve, Sl, by a ballbearing race, B, and a carbon dry-sleeve bearing, C. A gland-ring and packing, G, together with O-ring seal, S, make vacuum-tight the annular space between shaft and sleeve so that mixings can, if necessary, be carried out under inert gases or at pressures from a few mm Hg to several atmospheres by appropriate connections to the gas inlet and outlet ports, P. Rotation of a capstan-head, H, which is calibrated by a helical scale, lowers or raises the chamber to a selected depth of insertion of the rotor.

The normal operating procedure is to wind the capstan-head to give the maximum retraction of the rotor into the shaft sleeve and attach the chamber containing the materials for mixing. If necessary, the gas in the mixer is then changed and the chamber immersed to a depth of several inches below the surface of liquid in a portable thermostatically controlled bath. The capstan-head then raises the chamber with occasional revolution of the rotor until the latter bears on the bottom of the chamber. Mixing is carried out for a period controlled by a time switch on the electrical supply to the motor.

Performance of the Uni-Rotor

Degradation Efficiency. A wide variation in degradation efficiency is obtained by choice of temperature or rate of rotation of the blade. An alternative means of varying efficiency is to use a chamber tapering to the closed end and a complementary rotor (Figure 4) to give various clearances when the rotor is inserted to varying depths. Spacers provide predetermined clearances when the rotor is lowered until it bears on the bottom of the chamber.

Temperature Control. An important distinction between the uni-rotor and conventional small mixers is temperature control of the masticating material within relatively narrow limits, for example, within 5°C. and 2°C. of the temperature of the thermostatting liquid at 20°C. and 140°C. respectively for normal rates of breakdown of natural rubber. It is, however, often convenient in simple compounding to dispense with immersion in a thermostatting liquid.

Variation of Charge. Similar efficiencies of compounding are obtained with a variation of charge of greater than one to five in any selected chamber. The chambers shown in Figures 1 and 4 take charges of 2 to 10 g. and 10 to 50 g., respectively.

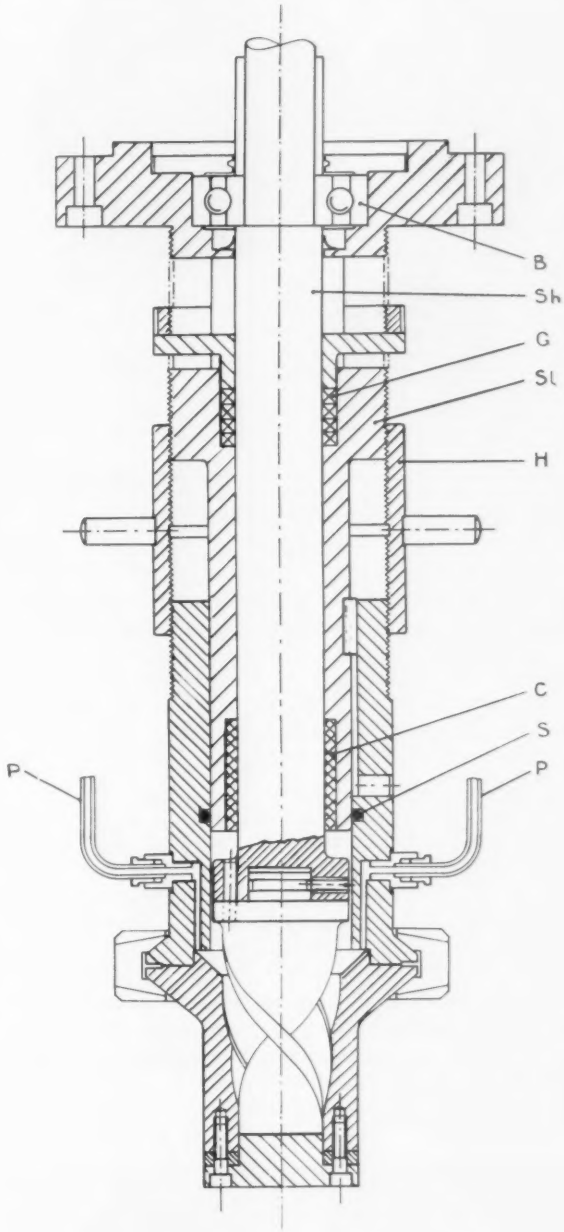


FIG. 3—Schematic diagram of the mixing assembly.

Mixing of Rubber and Additives. Under normal conditions of mastication in air during which rubber is softened and becomes tacky, vulcanizing ingredients added initially with unmasticated smoked sheet are incorporated within

FIG. 4—An alternative means of varying degradation efficiency is to use the chamber tapering to a closed end and the complementary rotor shown here.

a few minutes mastication. The chamber after mastication appears visibly as clean as it was originally, and no batch-to-batch transfer of small amounts of material has been detected. The homogeneity of compounded gum stocks was tested by vulcanizing and swelling samples from different parts of the same sheet in *n*-decane. No inhomogeneity was detectable within the ± 1% accuracy of the swelling measurement.

Carbon black in amounts at least up to tire tread stocks is also satisfactorily incorporated after a few minutes mastication of the materials which are added in one batch. Homogeneity tested for as described above was within experimental error. A hole drilled in the detachable chamber allowed slow addition of carbon black and other solids, and especially of liquids.

Mixing of Plastics. Thermoplastic substances at appropriate temperatures have been treated in the mixer in the same way as rubbers. For example, polythene, polystyrene and polymethylmethacrylate were mixed at 120°, 130°, and 190°C., respectively. As an illustration of the homogeneous mixing achieved by the unit, samples taken from different parts of a mass of polystyrene mixed with a small amount of a dye had optical densities within 1% of the value calculated for the amount of dye added.

Other Mastication Equipment. Other rotor and chamber designs have proved of value for special purposes. A spiral-scrolled rotor and chamber (Figure 5) have been employed extensively in investigations of degradation caused by shearing forces and mastication-induced polymerization. A plough-shaped rotor (Figure 6) has been used for mastication-polymerization and the mixing of very stiff materials.

Conclusions

The most pertinent questions concern the advantages achieved by the distinctive features of this one-rotor machine as compared with two-rotor laboratory mixers. Some of these advantages can be summarized briefly as follows:

(1) Simplicity and low cost of construction.
(2) Energy available to up to one h.p. per g. material.
(3) Even torque characteristics.
(4) No contact of masticating materials with seals or glands.
(5) Ease of operation and economy of batch size.
(6) No ram required nor feed for additives.
(7) A five-fold variability of charge without impairing mixing efficiency.
(8) Insignificant charge losses or batch-to-batch retention
(9) Rigid control over both temperature and gases present.

ACKNOWLEDGEMENT

We are pleased to record our thanks to members of the staff of Baker-Perkins, Ltd., Peterborough, for their encouragement and assistance. Baker-Perkins, Ltd., built the machine and is currently collaborating under license in the development of laboratory and larger mixers employing the uni-rotor principle. We also wish to thank Dr. Bateman and the Board of British Rubber Producers' Research Association for permission to publish this article.

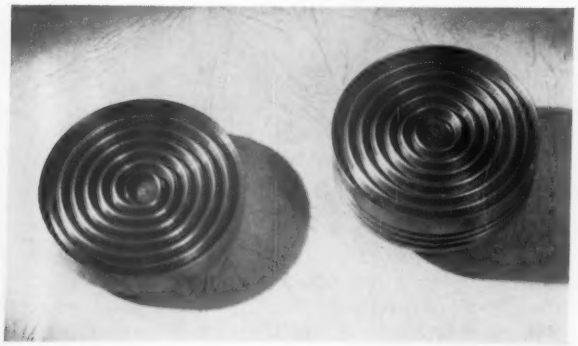


FIG. 5—This spiral-scrolled rotor and stator have been used in investigating degradation caused by shearing forces and mastication-induced polymerization.

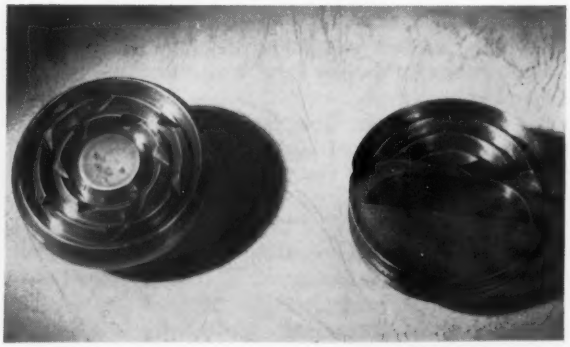


FIG. 6—This plough-shaped rotor and stator have proved useful for mastication-polymerization as well as for the mixing of very stiff materials.

Editorials..

Stockpile Bogie

► WE HAVE frequently referred in these columns to the fact that synthetic rubber hangs over the heads of producers of natural rubber like a Damocles' sword. The expression was used to indicate that the production and availability of synthetic rubber in the United States would act as a brake on both the expanded cultivation and the price of natural rubber. There is little doubt that this effect has been achieved, although it is freely admitted that additional supplies of natural rubber will be required in the future to meet the increasing world-wide demand for new rubber in the years to come.

It now appears that a second Damocles' sword is dangling over the heads of the natural rubber producers. Recent conversations with leading estate producers elicited the information that such producers are eyeing the natural rubber stockpile in the United States with considerable apprehension. Recent announcements from Washington have done little to allay the fears of the natural rubber producers that some day in the near future a decision will be reached to whittle down the rubber stockpile. It does not take any great amount of imagination to see natural rubber prices substantially reduced during the whittling down process. Who, then, can blame the natural rubber producer for thinking twice before he embarks on new planting or even re-planting?

Stockpile Statistics

What are the facts? Well, we believe the natural rubber stockpile amounts to approximately 1,200,000 long tons and we know that the rubber is kept fresh by the rotation method. We know, too, that pressure is brought on the authorities from time to time to reduce the size of the stockpile, valued at well over $1,000,000,000, especially in view of the fact that the *cis*-polyisoprene rubbers can be successfully used in truck and bus tires, reducing our dependency on natural rubber. We are also aware of the fact that maintenance or reduction of the stockpile is a favorite topic among administration and military executives in Washington.

The apprehension of natural rubber producers was increased recently by the announcement by Gordon Gray, director of the Office of Defense Mobilization, to the effect that a citizens' advisory committee has been formed to undertake a thoroughgoing review of the $6,500,000,000 stockpile of strategic materials. The committee, which includes executives from government, industrial, military and academic fields, will not only analyze materials now in warehouses, such as rubber, but will also study whether to stockpile additional items, such as food and medical supplies.

According to Mr. Gray, "the comprehensive review was dictated by changed military concepts." Asked whether reductions of some materials was in prospect, the ODM director emphasized the point that Administration policy still was not to dispose of materials in the strategic stockpile, but added that disposal was one of the problems which will be considered by the committee. For the record, Holman D. Pettibone, chairman of the board of the Chicago Title and Trust Co., is chairman of the advisory committee. Mr. Pettibone was the chairman of the Synthetic Rubber Producing Facilities Disposal Commission.

Stockpile Reduction Unlikely

We do not pretend to have any inside information where the natural rubber stockpile is concerned. However, we think it very unlikely that any reduction—substantial or minimal—will be made in that stockpile as long as the "cold war" continues. The military authorities are strongly opposed to a reduction of any kind, despite the availability of synthetic rubber and the prospect that we may soon have in substantial quantities a synthetic rubber which can effectively replace natural rubber in heavy-duty tires. Their argument is simple, namely, either missiles or sabotage could quickly put our major synthetic rubber facilities out of kilter. Should such a situation occur, we would still have the stockpile. This is typical military thinking where depth is required.

On the Administration side, the State Department, for reasons of diplomacy, is equally opposed to any movement of the stockpile which would affect the price of natural rubber and therefore the economy of the Far East, principally, Malaya and Indonesia. Such an action would be particularly unfair to Malaya which only recently acquired its independence. The State Department is keenly aware that the communist infiltration of the Far East has only been halted not stopped, and any weakening of the economy in that area would provide an open door to the communists.

Slow and Orderly Reduction

There is no gainsaying the fact that some members of the Administration concerned with the rubber stockpile favor reduction. However, the discussion among these administrators is that any reduction which might be made would be made in slow and orderly fashion, making certain that the rubber released for sale from the stockpile would not interfere with regular market movements and conditions. We have even heard a figure of 50,000 long tons a year mentioned. If such a figure proved accurate, it would take approximately 24 years to eliminate the stockpile, providing there is actually 1,200,000 long tons involved. We are still willing to wager that there will not be any change in the natural rubber stockpile for many years to come.

Highlights Sidelights *of the News...*

November, 1957

General Tire & Rubber Co. has officially opened its synthetic rubber plant at Odessa, Texas . . . Butadiene will be supplied by El Paso Natural Gas Co., which formally dedicated a new butadiene plant at the same time . . . The General Tire operation, which will produce 40,000 long tons of styrene rubber a year, features many design innovations (page 301).

Harwick Standard Chemical Co., celebrating its twenty-fifth anniversary, has grown from a one-room office started in a depression year to a nation-wide organization serving manufacturers from coast-to-coast . . . Hundreds attended an open house observance of the anniversary (page 309).

John W. McGovern has been elected president of the U.S. Rubber Co. in a realignment of executive personnel which finds H. E. Humpreys, Jr., continuing as chairman of the board and chief executive officer . . . Mr. McGovern is now chief operating officer of the concern (page 303).

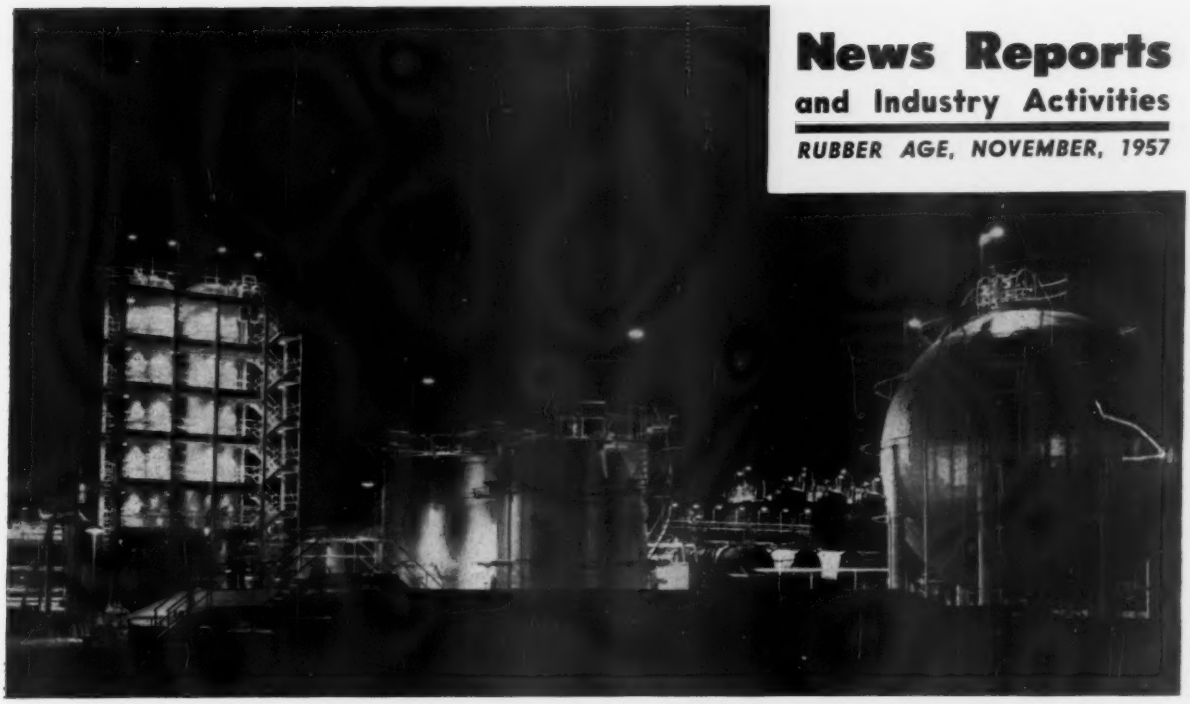
All the past chairmen of the New York Rubber Group were honored at the Fall Meeting by the presentation of scrolls in recognition of service rendered . . . new officers were elected . . . an address on colored rubber compounding was given (page 304).

Flemington, N. J. is the home of a new million dollar polyvinyl chloride resin plant just opened by Cary Chemicals, Inc. . . . Total monthly output is to be one million pounds . . . Over 350 well-wishers were in attendance at the formal opening (page 310).

A synthetic rubber shortage has been forecast by the chairman of the Goodyear Tire & Rubber Co. . . . He recommends that the U. S. give technical and financial assistance to foreign countries for the construction of facilities (page 315).

Centralization of all reesarch activities at the Bound Brook, N. J., plant of American Cyanamid Co. has been achieved by the opening of a new $2 million dollar installation . . . Dedication ceremonies featured an address by Dr. Paul Gross, vice-president of Duke University (page 306).

A 45 per cent increase in tire sales over the next decade is foreseen by the chairman of the board of U. S. Rubber Co. . . . Speaking to the annual convention of the National Tire Dealers and Retreaders Association, he said dealers will be selling 80 million tires annually ten years from now (page 319).



Here is an over-all night view of the monomer handling areas at the new synthetic rubber plant constructed by General Tire at Odessa.

General Tire Opens New Synthetic Plant

New Industrial Complex at Odessa, Texas Features Butadiene Plant and Soon to be Completed Styrene Facility

► The General Tire & Rubber Co. officially opened its new synthetic rubber plant at Odessa, Texas, on October 18, joining with the El Paso Natural Gas Co. who formally dedicated its new butadiene plant at the same time. The two plants, built at a cost of $32 million, officially went on stream as the result of an agreement signed a little less than two years ago by both companies.

The two plants are part of a new chemical complex involving a synthetic rubber plant, a butadiene plant, a styrene plant, and a refinery-alkylation plant capable of producing 6,500 barrels of high octane gasoline a day. Both the styrene plant and the refinery are scheduled for completion early in 1958.

The styrene plant will furnish the copolymer plant with styrene. The refinery, in turn, will take a stream of by-products from the butadiene and styrene plants, including butylene, isobutane and propylene, and convert them into high octane gasoline.

General Tire's new synthetic rubber facility will produce 40,000 long tons of styrene rubber a year from the butadiene and the styrene supplied from the adjacent facilities. A long-term agreement between General Tire and El Paso covers the production and sale of styrene and butadiene to supply the new copolymer plant.

Built at a cost of $10 million, General Tire's new plant at Odessa is said to be radically different in design from all other synthetic rubber plants in that it combines the ability to produce in a continuous stream with a unique versatility.

J. A. Pollack, plant manager, explains that the profound difference with other plants is made possible by maximum use of instrumentation, an entirely different and highly efficient plant layout, and vastly improved equipment. The plant utilizes a total of 880 different instruments, all relaying their passages to a supersensitive nerve center for absolute and continuous control by a single operator. "Revolutionary improvements in design have made it possible to produce the same number of tons per man in a small plant as can be obtained in a plant four to five times as big," said Mr. Pollack.

Versatility of the new plant is apparent in its ability to produce either hot or cold rubber and to oil-extend both white and black rubber. Also, while designed for continuous production, the down-time normally associated with a changeover from one product to another has been all but eliminated. A modern pilot plant, separate from the production units, will be used for experimental test runs. Development work will be aimed at utilizing the maximum capabilities of the plant, thus bringing about more and more efficient production.

Butadiene Plant Background

The $22 million butadiene plant which will feed General Tire's copolymer unit, was built by the Odessa Butadiene Co. Odessa Butadiene was expressly organized for this purpose. The majority owner in Odessa Butadiene is the El Paso Natural Gas Products Co., wholly owned subsidiary of the El Paso Natural Gas Co. Other owners of Odessa Butadiene include W. D. Noel and E. G. Rodman of Odessa, Texas, and the United Carbon Co.

The butadiene plant is geared to produce 50,000 tons yearly. Of this sum, 32,000 tons will be used by the General Tire copolymer plant. The remainder will be shipped to the copolymer plant operated by the United Rubber & Chemical Co. at Baytown, Texas. United Rubber is a subsidiary of United Carbon. The soon-

This aerial photograph provides a bird's eye view of the new butadiene plant (background) and synthetic rubber plant (foreground).

to-be-completed styrene producing facility is designed to produce 20,000 tons annually. The plant is being constructed at a cost of $5.5 million. As soon as this plant is in production, it will service General Tire's copolymer facility. El Paso Natural Gas Products Co. is the majority owner of the styrene plant and owns the new refinery outright. United Carbon is a minority stockholder in the operation.

Ceremonies highlighting the opening of the synthetic rubber and butadiene plants featured plant tours and addresses by officials of both companies. William O'Neil, president of General Tire, stated that the synthetic rubber plants built during the war emergency by the government are now about 16 years old. Their equipment, he said, does not lend itself readily to such improvements as have been incorporated into the company's new plant.

General Tire operated the government-owned synthetic rubber plant at Baytown, Texas, from 1943 until April of 1955. The company presently operates a tire plant at Waco, Texas.

Plastics Hose Standard Issued

► U. S. Department of Commerce has issued Commercial Standard "CS209-57" covering the vinyl chloride plastics garden hose. Sponsored by the Society of the Plastics Industry, Inc., and prepared and approved by garden hose manufacturers and major consumers throughout the country, the standard incorporates a "Seal of Quality" which may be displayed on hose which meets its requirements. Test procedures and requirements contained in the standard were developed by manufacturer members of SPI in order to provide basic quality requirements that would insure the user of a satisfactory product. This industry standard incorporates requirements and test methods for vinyl chloride plastics garden hose in respect to burst strength, low-temperature flexibility, water extraction, performance of couplings and appearance. The standard also contains dimensions and tolerances on this product. Plastics garden hose manufacturers, in cooperation with the Society of the Plastics Industry, Inc., have initiated a nation wide educational and publicity program to acquaint users with the advantages of purchasing plastics garden hose that conforms with the requirements of the U. S. Department of Commerce standard.

Sale of Hannifin Completed

► Parker Appliance Co., Cleveland, Ohio, has completed its purchase of the Hannifin Corp., Des Plaines, Ill., for about $7,500,000. Of this, $5,500,000 was paid in cash, $1,500,000 in notes, and the balance in Parker stock. Elwood G. Peterson, president of Hannifin, has been elected a vice-president and a director of Parker. Share-holders of Parker Appliance approved changing the name of the new acquisition to the Parker-Hannifin Corp. Hannifin makes air power and hydraulic presses and cylinders and components used in liquid, gas or air pressure systems.

New Ordnance Products List

► The Ordnance Corp., Department of the Army, has announced the issuance of Military Specification MIL-R-3065B (Ord), "Rubber, Fabricated Parts." This specification requires qualification test approval for twenty-one rubber grades defined in MIL-STD-417 (Ord), dated September 10, 1957. The Ordnance Corps is developing a list of suppliers for the twenty-one rubber grades requiring qualification. Interested suppliers of such rubber compositions are requested to address their inquiries to the Laboratory, Rock Island Arsenal, Rock Island, Ill.

Morningstar and Federal Merge

► Officers of Morningstar, Nicol, Inc. and Federal Adhesives Corp., both of New York City, have announced the affiliation of their companies, effective October 9. Federal Adhesives, manufactures specialty adhesives and maintains a manufacturing affiliate in Baltimore, the Adex Manufacturing Co. The affiliation also includes Federal Latex Corp., which manufactures rubber latex compounds; and Federal Chemicals Corp., which manufactures industrial chemicals and vinyl plastisols. A Morningstar subsidiary, Paisley Products, Inc., is in a similar line of business, manufacturing industrial and packaging adhesives, polyvinyl acetate resin emulsions and many chemical specialties. The companies believe that the research, technical and production facilities of the combined Paisley and Federal organizations will improve service to customers on a nationwide basis. Paisley operates manufacturing plants in New York, Chicago, St. Louis, Los Angeles and Redwood City, Calif., with sales offices in principal cities of the United States and Canada. Sales and technical service staffs of both companies will continue unchanged, each specializing in its particular field. Key personnel of all the Federal organizations including management, sales, technical and production have become members of the Morningstar organization.

Appointed Bakelite President

► R. K. Turner has been appointed president of Bakelite Co., a division of Union Carbide Corp., New York, N. Y., succeeding George C. Miller, who has been appointed president of Union Carbide Realty Co. Stanley A. Corfman, former president of Union Carbide Realty, will reach retirement age next summer. Mr. Turner joined Union Carbide in 1924 in the Research Department of the Union Carbide Chemical Co. at Clendenin, West Va. He was named general superintendent of the South Charleston plant in 1940, and in 1946 he moved to New York to fill the post of assistant works manager for the company. He was appointed vice-president of Bakelite in 1952. Mr. Miller began his association with Union Carbide in 1922 with the Linde Co. He also did early plastic research development for Union Carbide Chemicals. He was appointed vice-president in charge of sales for Bakelite in 1952 and president in 1953.

New Instron Unit Planned

► Instron Engineering Corp., Quincy, Mass., has announced that the company is building a new 25,000 square foot plant in Canton, Mass., in order to meet increasing demand for its electronic equipment. To be located at the intersection of Routes 128 and 138. Instron's new plant will be devoted to the design and production of universal testing machines and other electronic test equipment. The building will also house the company's administrative and engineering offices.

McGovern | Luxenberger | Vila | Pennington | Ebers

McGovern Elected President of U. S. Rubber Co. in Realignment of Executive Personnel

► John W. McGovern has been elected president of the U.S. Rubber Co., New York, N. Y., and designated chief operating officer by the board of directors. Formerly executive vice-president, Mr. McGovern succeeds H. E. Humphreys, Jr., as president. Mr. Humphreys continues as chairman of the board of directors and chief executive officer.

Mr. McGovern, a native of Philadelphia, Penna., joined U.S. Rubber in 1920 as an accountant in Boston. After serving in numerous accounting, industrial engineering and production posts, Mr. McGovern became general manager of the Tire Division in 1943. He was elected a vice-president in 1945, a director and member of the Executive Committee in 1951 and executive vice-president in 1956.

At the same time, the board designated vice-presidents Eugene A. Luxenberger and George R. Vila as group vice-presidents. Mr. Luxenberger, formerly vice-president and general manager of the Footwear and General Products Division, will be responsible to the president for the operation of the company's Tire Division, Footwear and General Products Division, and for the Mechanical Goods Division.

Mr. Vila, formerly vice-president and general manager of the Chemical Division, will be responsible to the president for the operation of Dominion Rubber Co., Ltd., Latex Fiber Industries, Inc., and the Chemical, Textile, International and Plantation Divisions.

The board also elected Earle S. Ebers a vice-president and appointed him general manager of the Chemical Division succeeding Mr. Vila. C. William Pennington was elected a vice-president and appointed general manager of the company's Footwear and General Products Division succeeding Mr. Luxenberger.

Changes Membership Policy

► At the council meeting of the Federation of British Rubber and Allied Manufacturers, which was held at Southport, England, on September 25, the Federation accepted into associate membership some seventeen companies which manufacture machinery, chemicals or components for the British rubber industry in the United Kingdom or the Commonwealth. This formal acceptance sets the seal on the new policy begun at the annual general meeting in June, when the title of the Federation was changed and new Articles of Association were adopted allowing a class of associate membership to be set up. The suppliers now in this class represent an initial list and the further applications received since the council meeting will come before the council at an early date.

Appoints Japanese Agent

► Glyco Products Co., Inc., New York, N. Y., has entered into an agreement with Ataka and Co., Ltd., Osaka, Japan, by which the latter becomes the exclusive selling agent for the company's products in Japan. Under this agreement, Ataka will handle all of Glyco's products including polyol fatty esters, synthetic waxes, water-soluble resins and "Tetrine" sequestering agents.

Insoluble Sulfur Unit Completed

► Stauffer Chemical Co., New York, N. Y., has completed construction of a new unit at the company's Monongahela, Penna., plant for the manufacture of an oil-treated formulation of insoluble sulfur. A specially developed oil is used in the manufacture of this material which is said to be compatible with all types of rubbers. The new product will be marketed under the "Crystex" trade name as a special grade. According to the company, the product has a low dusting level which reduces fire hazards and also has superior properties in terms of ease of dispersion in rubber formulations.

Plans Linear Polyethylene Unit

► E. I. du Pont de Nemours & Co., Inc. has announced plans calling for the construction of a plant to produce linear polyethylene resins on a 600 acre site west of Laplace, La. Final decision on the construction of the plant will hinge on engineering studies and cost estimates now being made. DuPont has been in commercial production of conventional polyethylene since 1943. For the past two years, the company has been producing experimental quantities of the new resin in a pilot plant at Orange, Texas.

Price Increases Announced

► Within the past few weeks, various companies have announced price increases on a number of different rubber items. Goodrich, for example, has announced a 3 per cent increase on all shoe products, including all types of heels and soles. Hewitt-Robins has set a 5 per cent increase on its foam rubber cushioning products, while Goodrich has advanced its sponge rubber carpet cushions by 6 to 7 per cent. Many companies have announced price increases of 2 per cent on original equipment tires. In almost all instances, price rises announced by one company were followed by similar increases by others in the field. In general, the increases were attributed to higher labor, manufacturing and freight costs.

Purchase Pusey & Jones

► A group of business men, headed by Joseph B. Ulicny of New Brunswick, N. J., have purchased the 109 year old Pusey & Jones Corp., metal fabricators, shipbuilders and manufacturers of papermaking machinery, according to current reports. The price was not disclosed. The transaction was said to involve outright purchase of the concern from the Aquaterra Co. of Wilmington, a holding corporation.

Past chairmen of the New York Rubber Group who were in attendance at the October 4th meeting held at the Henry Hudson Hotel in New York City, are shown above in the usual order, including the Messrs. Gibbons, Silver, Miscall, Soule, Ingmanson, Wyrough, Murawski, Buffington, Vacca, Martin, Provost, Breckley, Corrigall, Jones, Collier, Conover, Haynes, Traflet, Bartle, Coe, and Gartrell.

New York Rubber Group Honors Past Chairmen at Fall Meeting

October 4th meeting includes the presentation of scrolls to past chairmen of the group and an election of officers for the new season

► The October 4th meeting of the New York Rubber Group held at the Henry Hudson Hotel in New York City attracted some 210 members and guests who participated in a program featuring the presentation of scrolls to past chairmen of the organization, an election of officers, a paper on "Designing Colored Rubber Compounds" by Victor H. Vodra of the Wooster Rubber Co., and the showing of a 27-minute motion picture, in color, entitled "This is Color."

Elected 1958 Officers

The following members were elected to office for 1958: *Chairman,* C. V. Lundberg (Bell Telephone Laboratories); *Vice-Chairman,,* R. B. Carroll (R. E. Carroll); *Secretary-Treasurer,* M. E. Lerner (RUBBER AGE). Frank J. Raba was elected sergeant-at-arms. L. C. Comar (Titanium Pigments), L. J. Koch (Westwood Chemical), B. B. Doherty (Godfrey L. Cabot) and R. M. Glidden (Ames Rubber) were elected directors.

A. A. Somerville, who served as temporary chairman of the New York Rubber Group when it was first organized in 1928, served as master of ceremonies at that portion of the meeting devoted to the presentation of scrolls to the past chairmen. Following the distribution of the scrolls to the past chairmen, Dr. Somerville was himself presented with a scroll by Herbert J. Due (St. Joseph Lead).

Recipients of the scrolls and the years in which they served as chairman, appear in the box to the right.

All of the past chairmen were in attendance with the exception of W. H. Whitcomb, who passed away in 1955, and the Messrs., Sturtevant, Kemp, Wright, Nellen, Outcault and Waters, who were unable to be present.

In his paper on "Designing Colored Rubber Compounds", Mr. Vodra noted that a great many papers have been written on the application of colors in rubber, but few of these serve as a step-by-step guide to the building of practical colored rubber compounds. The purpose of this paper was to fill this gap and in doing so the author presented a point-by-point analysis of the situation. He did not attempt to cover every type of elastomer, but discussed basic principles.

Start With Clean Rubber

In order to make the cleanest, brightest compounds, the author stated, it is first

Recipients of Scrolls

W. A. Gibbons (1928-29)
W. L. Sturtevant (1930)
W. H. Whitcomb (1931)
J. P. Coe (1932)
A. R. Kemp (1933)
C. J. Wright (1934)
B. R. Silver (1935)
R. D. Gartrell (1936)
J. Miscall (1937)
C. A. Bartle (1938)
A. H. Nellen (1939)
C. R. Haynes (1940)
K. J. Soule (1941)
F. E. Traflet (1942)
J. H. Ingmanson (1943)
F. S. Conover (1944)
H. E. Outcault (1945)
G. J. Wyrough (1946)
S. Collier (1947)
J. E. Waters (1948)
P. P. Murawski (1949)
D. E. Jones (1950)
M. R. Buffington (1951)
J. S. Corrigall (1952)
G. N. Vacca (1953)
J. Breckley (1954)
S. M. Martin, Jr. (1955)
G. H. Provost (1956)

necessary to start with clean, light rubber. The lightest possible reinforcing resin should be selected. Uniformity of color of every ingredient is important, Mr. Vodra noted, and, in general, clean, "crisp" ingredients should be used. The speaker made the point that the use of whiter clays means the need for lesser quantities of titanium dioxide and lesser amounts of color.

He noted that somewhere between 20 and 30 parts of titanium dioxide per 100 parts of elastomer will usually maintain satisfactory color. He also observed that zinc oxide reduces batch-to-batch variation without masterbatching. Mr. Vodra disclosed that in order to maintain an exact color match throughout the entire line, his company uses a low brightness clay for low loadings, an intermediate brightness for intermediate loadings and high brightness clay for high loadings.

Color Changes in Compounding

In discussing softeners and processing aids, he pointed out that the compounder should select saturated materials to reduce color changes during vulcanization and aging. Certain colors, such as some phthalocyanine blues, will crystallize out of aromatic and naphthenic solvents and plasticizers, and their use together should be avoided. As to age resistors, the compounder should select those which are not photosensitive or which are dark and bloom to the surface.

Mr. Vodra also suggested that the sulfur content be kept as low as possible. Avoid discoloring accelerators, he said, such as guanidine and condensed anilides for the lightest colors, unless the sulfur content is very low. He also suggested the use of premium grade colors, although the prices of these materials are sometimes disturbing.

The speaker declared that if the color in a compound migrates, the use of more color should be investigated. Colors should be tested for resistance to soap bleeding, detergents and greases. As to the problem of mold staining, Mr. Vodra stated that he has not found any lubricant which can be satisfactorily used without discoloring the finished part. He noted, however, that chrome plating reduced mold staining.

The sound motion picture, "This is Color", was presented through the courtesy of the Interchemical Corp. The film was introduced by F. L. Wurzburg, Jr., who, after the film was shown, exhibited slides taken from the motion picture and discussed them as they applied to the rubber industry. Mr. Wurzburg also answered questions from the floor.

The technical portion of the meeting was followed by a cocktail hour and the serving of dinner. This, in turn, was followed by a program of entertainment featuring Tennyson Guyer (Cooper Tire), who delivered an informative and entertaining address.

At a meeting of the Executive Committee preceding the regular meeting, it was reported that some 68 applications had been received from members interested in attending the course in basic rubber technology being offered by the group. It was also decided to name a committee to study questions involved in the incorporation of the group and to prepare a constitution and by-laws for the organization.

Group finances were said to be in good shape. The members decided to hold a dinner-dance this spring at a site and on a specific date which will be announced later.

Dr. A. A. Somerville, who served as temporary chairman of the New York Rubber Group in 1928 when the group was first organized, is shown receiving his scroll from H. J. Due, current chairman.

The new Research Center constructed by the American Cyanamid Co. at Bound Brook centralizes and expands product research activity.

New Research Center Dedicated by American Cyanamid

Opening of $2 million installation a feature of company's 50th anniversary celebration

► American Cyanamid Co. dedicated its new Research Center at Bound Brook, N. J., on October 18 with over 400 visitors and company representatives in attendance. Constructed at a cost of $2 million, the new Research Center centralizes nearly all of the product research conducted at Bound Brook. It provides for increased activity in the fields of rubber chemicals, dyes, textile chemicals and resins, and organic pigments. American Cyanamid is celebrating its fiftieth anniversary this year.

The new Research Center features a three-story completely air conditioned building containing approximately 52,000 square feet of floor space. The building is divided into two units, an administrative wing and a laboratory wing. The administrative wing includes a library, executive offices and conference rooms, while the laboratory wing consists of forty separate laboratory units, each suitable for two-man operation. The building is designed so that a second laboratory wing may be added in the future.

The program marking the opening of the Research Center included a tour of the new facilities, a luncheon, and the presentation of three technical papers at an afternoon session. At a brief formal ceremony, V. E. Atkins, former general manager of American Cyanamid's Organic Chemicals Division, presented a key to the Research Center to Dr. Robert P. Parker, general manager of the Research Division and to Dr. Joseph H. Paden, director of the Bound Brook Research Laboratories.

Three officers of the company participated in the ceremonies and made brief remarks. Present were George R. Martin, vice-president for services, General Anthony C. McAuliffe, vice-president in charge of engineering and construction, and Kenneth H. Klipstein, vice-president in charge of operations. In his brief address, Mr. Klipstein summarized the forty years of research at Bound Brook and emphasized the company's responsibility to use the Research Center for the advancement of scientific education and knowledge.

Dr. Paden presided at the luncheon, which featured an address by Professor Paul Gross, vice-president of Duke University, who spoke on "Five Decades of the Fifth Estate." Dr. Gross urged that industry and the federal government give more emphasis to basic research and insure open lines of communication to further our comprehension of nature.

The varied scientific activities of the International Geophysical Year and the launching of the space satellite by Russia, he said, are indicative of the accelerated pace and global nature of today's research and development and call for world wide dimensions in our thinking and in the communication of information.

The technical session which followed the luncheon included a speaker from each of the American Cyanamid research installations. In addition to the facilities at Bound Brook, the company maintains laboratories at Pearl River, N. Y., and Stamford, Conn. Dr. Richard J. Boyle spoke on "Ultraviolet Absorbers", while Dr. Seymour Bernstein discussed "Aristocort Triamcinolone—A New Anti-Inflammatory Agent." The final speaker, Dr. Frederic C. Schaefer, presented a paper on "Conversion of *s*-Triazine to Mono-Substituted Derivatives."

American Cyanamid organized its Research Division in 1954. Some 2,000 persons are presently engaged in research activities for the company. The 1957 budget allowed for $23 million for research activities. This figure represents approximately 4.5 per cent of total company sales.

Expanding Eastern Facilities

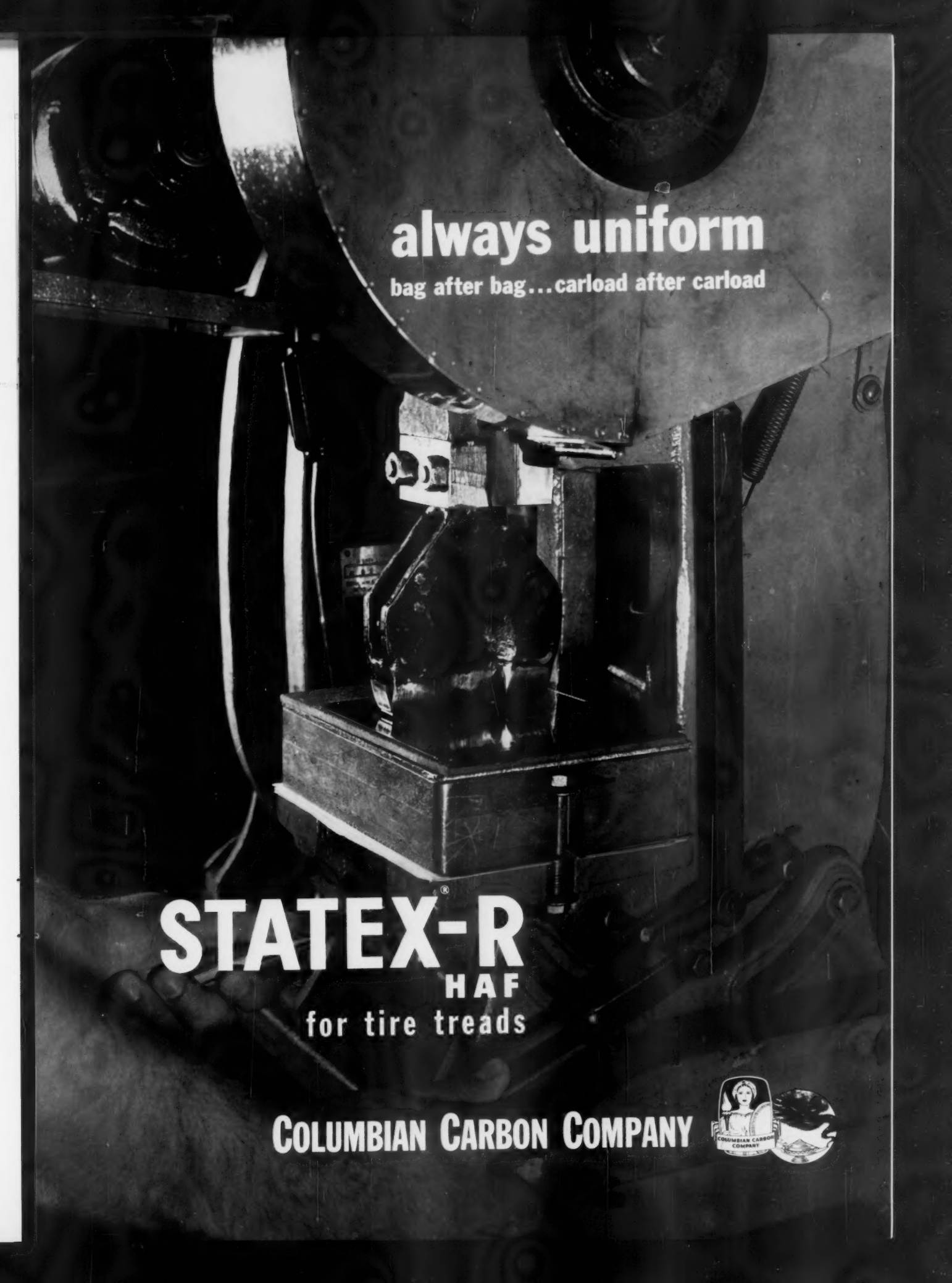
► Construction has begun on a major new addition to the East Coast manufacturing facilities of the Oliver Tire & Rubber Co., Emeryville, Calif. To be built by the Dural Rubber Co., Flemington, N. J., a subsidiary of Oliver Tire, the new facilities will cost $600,000 and will provide an additional 50,000 square feet of space. The latest in precision, high speed production equipment will be included in the unit which will be built on property in Raritan Township adjoining the present Dural buildings. Scheduled for completion by April, 1958, the new facilities are expected to handle over 25 per cent of the firm's $10 million volume.

New Phillips Appointment

► Phillips Chemical Co. has announced the appointment of Agmund K. Thorsrud as technical representative to assist Jan Willums, European sales manager for the company's carbon black and synthetic rubber. Mr. Thorsrud's headquarters will be in Zurich, Switzerland, where the company maintains an office. Mr. Thorsrud, who has had 10 years' experience in the rubber industry, is a graduate of the State University of Technology at Trondheim, Norway and spent two years at the French Rubber Institute in Paris. He is a former director of research and development at the Central Laboratories of A/S Askim Gummivarefabrik of Norway.

Develops New Gasketing Material

► Industrial Division of the Armstrong Cork Co., Lancaster, Penna., has announced the development of a new material for automotive lamp gaskets which is said to have excellent ozone resistance, low water absorption rate and a high degree of compressibility. The new gasketing material, called "Armstrong YK950", will compress 25 per cent to 40 per cent under a flange load of 40 psi. It is compounded of sponged butyl synthetic rubber and ground cork. Butyl provides good resistance to ozone while the cork particles supply resilience. Armstrong YK950 is manufactured in sheets and is designed primarily as an automotive lamp gasket.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(Fine Furnace)

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(High Modulus Furnace)

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COLUMBIAN CARBON COMPANY
380 Madison Avenue, New York 17, N. Y.

BRI Conference Scheduled

► Building Research Institute has scheduled a conference on December 4 and 5 at the Shoreham Hotel in Washington, D. C. to spotlight the growing importance of adhesives and sealants in building construction.

An introductory session, planned for architects, engineers, and building technologists, will identify all types of adhesive and sealant materials and explain the general nature of their uses. There will be talks on 1) adhesives, 2) sealing compounds, and 3) preformed gasketing materials and tapes.

The second session will report on "Sealing Joints in the Building Exterior," including metal curtain walls. Talks will be given on 1) glazing light-transmitting materials, 2) calking, and 3) sealing compounds and gaskets. There will be a building industry panel on the first two topics, and a sealants and building industries panel on the materials and procedures used and problems encountered in sealing metal curtain walls in the process of erection.

The third session, "Adhesives for the Building Exterior," will have lectures on 1) adhesives for floor surfacing materials, 2) adhesives for walls, ceilings and work surfaces, and 3) adhesives and sealants for building service systems such as plumbing, heating, and air conditioning, including the fabrication and assembly of duct work, insulation of pipes and ducts, gasketing of fixtures, grilles, outlets, etc. A panel of adhesives, sealants and building industries experts will discuss the topics of this session.

The fourth session will cover "Adhesives for Structural Materials and Components" with talks on 1) bonding agents for cementitious materials, 2) adhesives for wood laminated structural members, 3) glued and glue-nailed assemblies, 4) types of adhesives for sandwich panels, and 5) cores, skins and the fabrication of panels.

Session five will have talks on the "Future of Adhesives and Sealants in Building," with speakers on adhesives for metals and plastics, tapes for joining metal panels, and new adhesives for wood. A summary of these talks and a round-up of the meeting will close the conference.

For registration information and other particulars, write Harold Horowitz, Technical Secretary, Building Research Institute, 2101 Constitution Avenue, Washington 25, D. C. Conference registrants will receive, as part of their registration fee, a free copy of the proceedings, when published, containing all papers and discussions and a list of registrants.

Dow-Dobeckmun Merger Approved

► Stockholders have approved of the merger of Dobeckmun Co., Cleveland, Ohio, with the Dow Chemical Co., Midland, Mich. The new acquisition will be known as Dobeckmun Co. Division of Dow Chemical. Of the 515,893 common shares of Dobeckmun outstanding, holders of 93.5% ratified the merger proposal. Under terms of the merger, Dobeckmun owners receive ¾ of a Dow share for each share of Dobeckmun stock.

Pictured at the Open House celebration are H. W. Catt, general purchasing agent of the B. F. Goodrich Co.; Jack R. Moore, president of Harwick Standard; Mrs. C. J. Harwick, chairman of the board and treasurer of Harwick Standard, and R. W. Ostermayer, president of the Pennsylvania Industrial Chemical Corp.

Harwick Standard Celebrates Anniversary

► September marked the 25th anniversary of the Harwick Standard Chemical Company in Akron, Ohio. The birthday was celebrated by an Open House which was attended by hundreds of friends from all parts of the country. The date, September 28, was an eventful day that not only honored the small beginning of the business by Curtis J. Harwick in 1932, but also paid tribute to the men and women of the organization who carried on, expanding the business after Mr. Harwick's death in 1948.

In a quarter century Harwick's business of supplying compounding and processing chemicals to rubber and plastics manufacturers has grown from a one-room office, opened in a depression year, to a nationwide service with branch and warehouse offices serving manufacturers from coast to coast. A plant to house general offices, manufacturing and warehouse was built on Seiberling Street, Akron, in 1948. Then considered to be adequate for the company's needs for many years to come, the plant was soon outgrown. This year the capacity of that plant was doubled with the building of a new addition. This addition was completed and officially opened to the inspection of the anniversary party guests.

Heading the Harwick company's activities, through the Akron general office, is Jack R. Moore. He associated himself with Harwick as a chemist and technical sales representative in 1940. In 1948 he was elected president. Ray L. Lasser, purchasing and production man, was elected vice-president. In 1956, D. F. Behney was elected vice-president in charge of sales. Frank A. Sancic is secretary and assistant treasurer. Mrs. Curtis J. Harwick serves as treasurer and chairman of the board.

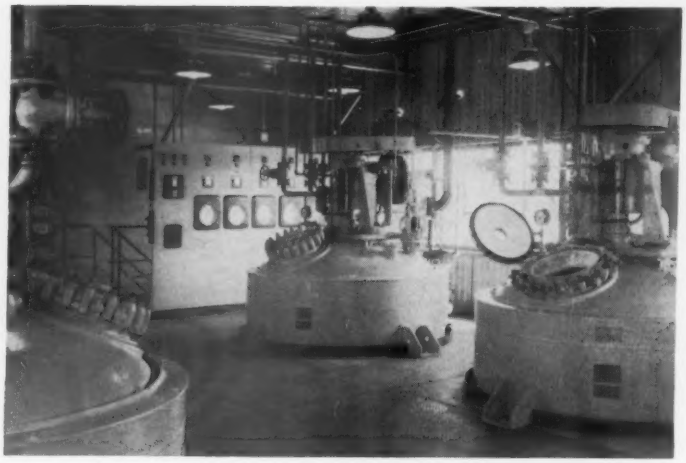
The Akron office is the nerve center of the far flung organization. From it the activities, sales and technical service of its chemists and representatives are directed through four subsidiary companies and offices in Boston, Trenton, Albertville, Alabama, Chicago, Denver and Los Angeles. The Massachusetts, New Jersey, Illinois and California subsidiaries are headed by C. A. Meyer, R. J. Salyerds, A. L. Robinson and D. C. Maddy, respectively.

Plans New Polyethylene Unit

► Dow Chemical Co., Midland, Mich., has announced plans to build a linear polyethylene plant at Bay City, Mich., scheduled to begin production next October. Dow's linear or low-pressure form polyethylene is said to be harder, tougher, more rigid and capable of greater heat and chemical resistance than the polyethylene that Dow has been producing in Texas for more than two years. The cost and capacity of the new plant have not been disclosed.

Moves To New Jersey Offices

► The executive, sales and accounting departments of American Hard Rubber Co., formerly located at 93 Worth St., New York, N. Y., have been moved to a newly constructed office building adjacent to the company's plant in Butler, N. J. In announcing the move, Newton H. Tuthill, executive vice-president and general manager of the company, pointed out that closer integration of the administrative and production functions of the organization will result.



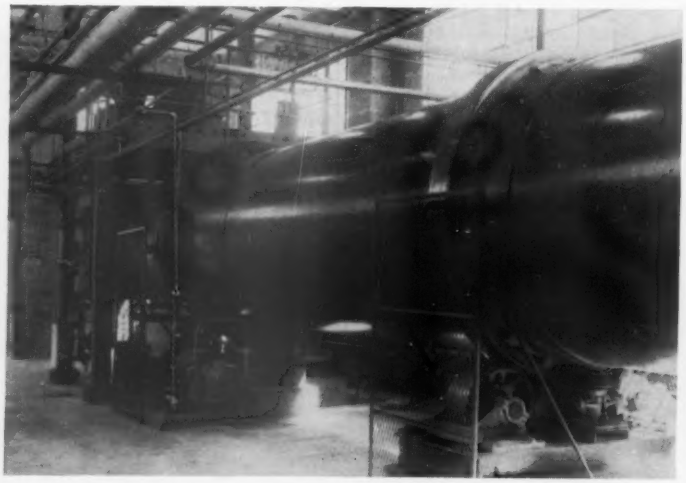
Several reactors are employed at the $1 million PVC plant.

Cary Chemicals Opens PVC Plant

► About 350 guests, including customers, state and local officials, stockholders, bankers, representatives of the press and employees, were in attendance at the open house which marked the opening of the new million dollar polyvinyl chloride resin plant by Cary Chemicals, Inc. at Flemington, N. J., on September 25. George F. Blasius, chairman of the board, acted as master of ceremonies and made the welcoming address. Other speakers included Kenneth B. Cary, president; state and city officials; Thomas Zawadzki, newly appointed vice-president in charge of sales and member of the board of directors, and Harry A. Rehnberg, president of the Scientific Design Co.

The new Flemington plant is located on a 28-acre tract. The plant has a capacity of 12 million pounds annually, but is so designed that production facilities can be doubled or tripled without difficulty. Planned and constructed by the Scientific Design Co., the new plant employs Scientific Design's polymerization process in the production of PVC resins having outstanding electrical properties. Part of the 1 million pound monthly output will be used by Cary Chemical's Milltown, N. J., plant in PVC compounds for the insulated wire and cable industry and for other industries. Cary Chemicals is said to rank fifth as producer of PVC chemical compounds.

A view of the rotary dryer at Cary Chemical's new Flemington plant.



RMA Schedules Full Program For 42nd Annual Meeting

► The results of extensive economic surveys undertaken by a special Business Research Committee over the past several months will be presented for the first time at the 42nd Annual Meeting of the Rubber Manufacturers Section on November 21 at the Park Lane Hotel in New York City. The presentation of this new committee's new study under the title of "Rubber Yardsticks" will be one part of a four-phase program covering subjects of importance to all rubber manufacturers in connection with their business planning.

Upwards of 200 rubber manufacturers are expected to attend the annual meeting, which is open to all company executives, regardless of affiliation with RMA. Principal speaker for the industry will be John L. Collyer, chairman of the board of the B. F. Goodrich Co., and a member of the RMA board of directors. Mr. Collyer's address at the luncheon session on "Progress in Rubber", will be of interest to all in the rubber manufacturing industry and will cap a morning program devoted to the theme "The Rubber Industry—A Record of Successful Performance."

John D. Wilson, vice-president of the Chase Manhattan Bank of New York, will open the morning program with an address on "Business in 1958." A well-known editor and author in the field of economics, Mr. Wilson's views on the probable pattern of business in the months ahead should be of wide interest.

A study on "The Rubber Supply-Demand Outlook" will be presented by W. J. Sears, vice-president of RMA and chairman of its Crude Rubber Committee. R. E. Davis, director of business research for the Goodyear Tire & Rubber Co., will present the new study, "Rubber Yardsticks." This presentation will deal with significant aspects of customer, employee and shareholder economics.

As moderator of the meeting, Ross R. Ormsby, president of RMA, will open the morning session to a question-and-answer period after the presentation by Mr. Davis. A brief reception will be held preceding the luncheon.

General Tire Stock Offered

► Kidder-Peabody & Co. and Associates, New York, N. Y., are offering a $12 million General Tire and Rubber Co. 6 per cent debentures issue. The 25 year debentures, with warrants attached, are priced at par. Warrants, exercisable beginning in 1958, allow purchase of 20 common shares at $25 each for each $1,000 principal amount of debentures up to October, 1962. The per share price rises to $27.50 through September, 1967. According to current reports, the debentures cannot be redeemed for lower interest cost within the first five years at less than 110. Regular redemption rates start with 106, up to October 1, 1958, and range downwards. A sinking fund is provided. Proceeds of the sale will be used to replace short-term financing as a source of working capital.

ACS Polymer Chemistry Unit Holds Meeting in New York

► The 132nd Annual Meeting of the American Chemical Society held recently in New York City, featured a meeting of the Division of Polymer Chemistry at which a number of papers pertinent to the rubber industry were presented. These papers covered such subjects as the incorporation of carbon black into polyethylene and the chemical grafting of vinyl monomers on to polyethylene. A summary of those papers which seem to have the greatest applicability to the rubber industry appears below:

In their paper on "Thermal Degradation of Polybutadiene, Styrene-Butadiene Copolymer, and Polyacrylonitrile" the authors, S. Straus, and S. L. Madorsky of the National Bureau of Standards, Washington 25, D.C., noted that the results of an investigation of the nature and distribution of products of thermal degradation of polybutadiene and of a copolymer of 75/25 butadiene and styrene were covered in an earlier paper. This paper extended the initial investigation to cover the kinetics of degradation of these substances. Rates of degradation were determined by a loss-of-weight method in a vacuum in the range 380° to 395°C. for polybutadiene, and 325° to 370°C. for the copolymer. These rates for polybutadiene indicated an activation energy of 60 kcal. per mole. The copolymer had very high initial rates of degradation, followed by rapid drop, so that it was not possible to obtain a reliable activation of energy.

Polyacrylonitrile Analyzed

Polyacrylonitrile was investigated with regard to the nature and distribution of volatile products as well as the rates of thermal degradation. The more volatile products, in the descending order of yields, were HCN, $CH_2 = CHCH_2CN$, CH_3CN, CH_3CH_2CN, and a few others totaling 12% by weight of the sample. Rates in the range 250° to 290°C., as in the case of the copolymer previously mentioned, were very high initially, but dropped rapidly, so that the activation energy could not be determined accurately. Comparative thermal stability in terms of a temperature, T_h, at which half the polymer is evaporated in 30 minutes of heating, shows a T_h of 403° for polybutadiene, 385° for the styrene-butadiene copolymer, and 317° for polyacrylonitrile.

In the paper on "The Effect of Carbon Black on Thermal Antioxidants for Polyethylene" by W. L. Hawkins and W. Matreyek, Bell Telephone Laboratories, Inc., Murray Hill, N. J., it was reported that two to three per cent of fine particle size carbon black effectively protects polyethylene against photoxidation and to a slight extent against thermal oxidation. Although the effectiveness of carbon black as an inhibitor increases with concentration up to as high as 25%, adverse effects on the physical and dielectric properties are apparent at concentrations above about 5%. Consequently, small amounts of such thermal antioxidants as aromatic amines and phenols are customarily added to inhibit thermal oxidation. However, conventional thermal antioxidants are less effective in polyethylene containing carbon black than in clear polyethylene.

For example, 0.1% diphenyl-*p*-phenylenediamine inhibits clear polyethylene oxidation for 300 hours at 140°C., but in polymer containing 3% carbon black, protection is reduced to only 150 hours. Most conventional antioxidants lose much of their efficiency in the presence of carbon black, and some are no more effective than carbon black alone. Apparently, this effect of carbon black on thermal antioxidants is dependent on particle size, since coarser carbon blacks have no effect on antioxidant efficiency. However, these coarser carbon blacks do not protect adequately against ultraviolet radiation.

Antioxidants Discussed

This paper was followed by one on "New Thermal Antioxidants for Polyethylene Containing Carbon Black" by W. L. Hawkins, V. L. Lanza, B. B. Loeffler and F. H. Winslow, also of the Bell Telephone Laboratories in Murray Hill, N. J. In this paper it was reported that thermal antioxidants such as aromatic amines or phenols lose much of their effectiveness in polyethylene containing a few per cent of carbon black. Condensation of these compounds with sulfur dichloride to form substituted thioethers produces a new type of antioxidant which is more effective in the presence of carbon black than in the clear polymer. These thioethers act like conventional antioxidants in clear polyethylene, in that the oxidation rate eventually becomes autocatalytic.

In the presence of carbon black, however, many of these new antioxidants act like retarders, reducing the oxidation of polyethylene to a slow, constant rate which does not become autocatalytic even after 2,000 hours at 140°C. In contrast, the best conventional antioxidants protect carbon black-polyethylene formulations for less than 200 hours under the same accelerated test conditions.

Alkyl, aryl, and heterocyclic thiols and disulfides without amino or phenolic substituents are also effective antioxidants in the presence of carbon black. Except for aryl benzyl sulfides and dibenzyl sulfide unsubstituted thioethers are ineffective The evidence indicates that in the presence of carbon black the RS′ radicals, postulated as intermediates, function as chain terminators, the authors stated.

Radiation and Polybutadiene

The paper by Morton A. Golub of the B. F. Goodrich Co., Research Center, Brecksville, Ohio, covered "Radiation-Induced Cis-Trans Isomerization of Polybutadiene". It was found that the cis double bonds in a high cis polybutadiene in solution may be transformed into the corresponding trans double bonds by the use of gamma radiation in the presence of a suitable sensitizer, which may be one of a variety of organic bromides, disulfides, or mercaptans. These sensitized isomerizations proceed in the direction of attaining an ultimate cis-trans ratio of approximately 10/90, which appears to be the thermodynamically favored condition for the carbon-carbon double bonds in polybutadiene. This result is analogous to the recently reported photosensitized cis-tans conversion in the same polymer (J. Polymer Sci., in press).

No isomerizations could be achieved when the polymer was irradiated with γ-rays in the solid state. The kinetics of the isomerization is first-order with respect to the cis content in the polymer. The mechanism probably involves π-complexing between the olefinic linkage and free bromine atoms in the one case, or mercaptyl radicals in the other case of sensitization. An interesting application of this isomerization is the possible use of this system as a dosimeter in radiation chemistry. An example of this application was given by the authors.

The paper entitled "Chemical Grafting of Vinyl Monomers on to Polyethylene" by J. E. Potts, E. F. Bonner, R. J. Turbett, and F. M. Rugg, Research and Development Department of the Bakelite Co., Bloomfield, N. J., described techniques for producing graft polymers by reaction of polyethylene of any molecular weight with vinyl monomers in the presence of chemical polymerization initiators. The monomers used in the present study include vinyl formate, vinyl acetate, vinyl chloride, and styrene. The effect of reaction variables such as monomer-polyethylene charged ratio, catalyst concentration, and dilution on monomer grafting efficiency is contrasted for different monomers.

Pure graft polymers of poly(vinyl acetate) and polyethylene were isolated and determinations made of the average number of poly(vinyl acetate) branches per polyethylene molecule and the average molecular weight of the branches. Various mechanisms which might account for the formation of these polyethylene-based graft polymers were considered and the preferred mechanism indicated.

UL Approves Rubber Compound

► Underwriters Laboratory has approved a rubber compound developed by Minnesota Rubber and Gasket Co., Minneapolis, Minn., for sealing applications in the handling of gas and other petroleum derivatives. Known as "Compound 503A", the compound has been approved for use with gas, kerosene naptha and LP gas, in both gaseous and liquid states at temperatures from 30° to 125°F. The Underwriters Laboratory approval cited the compound's use as synthetic rubber seal rings intended for use in gaskets between bolted joints, stems and shafts and as seals where rings of this sort are commonly used. This includes O-Rings, of which Minnesota Rubber is a major U. S. manufacturer, and the company's Quad Ring, a four-lipped sealing ring. The newly approved compound was developed after extensive experimentation and testing in the company's research laboratories. It is expected to provide a superior material for sealing devices used in fuel pumping, gas and oil transmission lines and other petroleum handling activities.

American Cyanamid Opens Permanent New York Exhibit

► A new, permanent exhibit center has been opened by the American Cyanamid Co. at Rockefeller Center in New York City in order to show to the public the vital role chemistry plays in helping the U. S. make better use of its resources in the fields of health, the home, the farm and in industry. Marking the 50th anniversary of the company's founding, the exhibit center includes such highlights as plastic electronic circuits to guide military missiles, and dioramas to show how chemistry has helped double the nation's food supply. Many displays are designed to allow audience participation. Industry's reliance on chemicals is highlighted in a series of panels and moving units that show the intricate connection between the original basic chemical compound and the finished consumer product. A map of the world, one of the largest ever made in metal, measuring 97 square feet, locates American Cyanamid operations.

The recently elected president of the company, Dr. Wilbur G. Malcolm, reported that American Cyanamid is in the midst of the largest expansion program in the company's history, with total capital expenditures in 1957 for new and increased facilities expected to reach an all-time peak of $75 million. In addition, he stated, outlays for research activities during the current year will total approximately $23 million. Dr. Malcolm has been associated with the American Cyanamid organization since 1934.

Wire And Cable Symposium Planned

► The Sixth Annual Wire & Cable symposium, sponsored jointly by the U. S. Army Signal Engineering Laboratories and industry, will be held at the Berkeley-Carteret Hotel, Asbury Park, on December 3, 4 and 5. Twenty-five papers will be presented during the three day conference, which will show the technical progress during the past year in the field of communication wires and cables. Headed by Howard L. Kitts, chief of the outside Plant Branch of the Communications Department, the committee consists of Howard F. X. Kingley, co-chairman; Ray Blain, U. S. Army Signal Communication Engineering Agency; C. T. Wyman, Bell Telephone Laboratories; George Hamburger, Copperweld Steel Co.; Vincent McBride, Plastic Wire & Cable Corp.; E. J. Merrell, Phelps Dodge Copper Products Co., and M. G. Gaines, Monsanto Chemical Co.

Basic Technology Textbook

► The Philadelphia Rubber Group advises that approximately 200 copies remain from the second printing of the book on "Basic Rubber Technology." The book, a compilation of fifteen lectures which constituted the complete rubber technology course sponsored by the Philadelphia Rubber Group, covers such subjects as natural and synthetic rubber, vulcanization, reinforcement, antioxidants and waxes, softeners and plasticizers, extenders and plasticizers, testing and testing equipment, processing equipment, factory processing, latices, foam rubber, and basic instruction on compounding. Single copies of the book cost $5.00. Two to twenty-five copies are available at $4.50 each. Twenty-six copies or more cost $4.00 each. Orders for books should be forwarded to A. J. DiMaggio, Firestone Tire & Rubber Co., Pottstown, Penna. Checks should be made payable to the Philadelphia Rubber Group.

Ontario Group Hears Talk on German Plastics

► The October 15th meeting of the Ontario Rubber Group held at the Pickfair Restaurant, Mimico, Ont., Canada, featured an address by D. M. Taylor, vice-president and research director of Organic Laboratories, Ltd., Brampton, Ont. Approximately 85 members and guests were present to hear Mr. Taylor speak on "Interesting German Plastic Practices and Material Development."

In his address, Mr. Taylor observed that whether the Germans are "leading" the United States and Canada in plastic material, product and technology development is fundamentally a point of view. The development and subsequent commercial history of such materials as polystyrene, polyvinyl polymers and copolymers, linear polyethylene and polypropylene indicates the direction in which the Germans may be said to have wide experience.

It should be remembered, the speaker emphasized, that Germany's vast chemical research activities kept their domestic economy and their war machine in full mobile shape in spite of metal shortages both preceding and during World War II. Rigid, non-plasticized polyvinyl chloride piping, tanks, etc., were developed to their present high degree of perfection some ten to twelve years ago. The techniques of cutting, machining and welding in Germany, are accepted as part of the general technology, whereas on this continent, they are considered as "specialty" fields.

The speaker stated that while we are engaged in a vinyl chloride "craze" at the moment, the Germans are developing linear polyethylene materials and directing a great deal of attention to rubber-plastic combinations. The Germans are also devoting a great deal of attention to the reclamation of plastic scrap, even coated fabric scrap, and the reprocessing of such materials into such products as flooring.

Mr. Taylor is of the opinion that the curve of German development in relation to that of other nations indicates that in many fields that country will maintain an unchallenged world position. U.S. and Canadian developments may lead the field in other areas, but in this general field, the answer seems to lie in closer cooperation between North America and Europe.

Plastics Exhibition Planned

► The British Plastics Exhibition and Convention has been scheduled to be held at Olympia, London, June 17 to 27, 1959. To be renamed the "International Plastics Exhibition and Convention", this is the fifth event of its kind and the second to show international exhibits. The exhibition will be organized by the Iliffe journal "British Plastics", with full support of the British Plastics Federation. Full details may be obtained from the organizers, "British Plastics", Dorset House, Stamford Street, London S. E. 1.

C. L. Shreiner

Named Chardon President

► Chardon Rubber Co., Chardon, Ohio, has announced the appointment of C. L. Shreiner, a founder and former executive vice-president of the company, as president and general manager succeeding V. M. Brediger, also a founder of the firm, who has retired from those posts. Mr. Brediger will continue with Chardon as vice-chairman of the board of directors. H. L. Oplinger will continue as vice-president in charge of manufacturing and has also been named senior vice-president. Mr. Shreiner had been executive vice-president since the firm began operations in 1930 and has been associated with the rubber industry for 34 years. A member of the Molded and Extruded Rubber Goods Division, Rubber Manufacturers Association, he served the Division as chairman from 1947 to 1949. He has been on numerous important industry committees and was a member of the Industry Advisory Committee to the Office of Price Stabilization from 1951 to 1953. A graduate of the University of Akron with a degree in rubber chemistry, Mr. Shreiner also served 11 years as a member of the Technical Committee for the Conservation of Natural Rubber and was co-chairman of an industry committee that prepared specifications for Naval inspection of molded rubber products. He is presently a member of the Industry's Advisory Committee. Mr. Brediger, the retiring president, had served as head of Chardon since 1935.

Develops Road Grader Tire

► Firestone Tire & Rubber Co., Akron, Ohio, has developed a new vibration-free road grader tire for precision road-building work. Called the "Super Ground Grip Roadbuilder", the new tire eliminates wave motion which makes precision grading difficult, the company states. The Roadbuilder has wider, flatter tread and rugged traction bars to give positive gripping action on all types of surfaces and an open-center tread features better cleaning and smoother operation at all speeds. The body is constructed of specially treated nylon cord which allows additional retreads. The new tire is available in either tubeless or tubed construction.

ACS Rubber Division Library Gives Current Listing of Bibliographies

► The Rubber Division Library maintained by the Division of Rubber Chemistry of the American Chemical Society at the University of Akron, Akron, Ohio, has announced a current listing of available bibliographies. For the convenience of our readers, the listing is reproduced:

No. 1—"Rubber Linings", March, 1952 48 references.

No. 2—"Mastication of GR-S", March, 1952, 91 references.

No. 3—"The Uses of Rubber in Agriculture", April, 1952, 34 references.

No. 4—"Drying of Adhesive-Coated Fabrics", April, 1952, 17 references.

No. 5—"Tire Design and Manufacturing", 1941-1951, April, 1952, 140 references.

No. 6—"The Processing of GR-S Involving the Use of Plasticizers", May 1952, 35 references.

No. 7—"The Use of Lignin in Rubber and Synthetic Rubbers", 1945—May 1952, 20 references.

No. 8—"Diaphragms—Part I, Rubber and Elastomer Materials", 12 references; Part II, "Metal Materials", 10 references, May 1952.

No. 9—"The Tensile Strengths of Natural and Synthetic Rubbers", June, 1952, 22 references.

No. 10—"The Use of Synthetic Resins in Natural and Synthetic Rubbers", June, 1952, 52 references.

No. 11—"The Determination of Ozone in Air", August, 1952, 41 references.

No. 12—"The Diffusion of Gases Through Natural Rubber and Butyl Rubber", October, 1952, 21 references.

No. 13—"Mills and Calenders—Part I, Operation", 8 references; Part II, "Safety Factors", 15 references, November 1952.

No. 14—"Compounding of Gutta-Percha and Balata Resins", November, 1952, 4 references.

No. 15—"Behavior of Gutta-Percha and Balata Toward Oxygen and Oxidation", November, 1952, 4 references.

No. 16—"The Tear Strengths of Natural and Synthetic Rubbers", February, 1953, 56 references.

No. 17—"Abrasion Testing of Natural and Synthetic Rubbers", June, 1954, 160 references.

No. 18—"Rubber-to-Metal Bonding (Excluding Brass Bonding)", December, 1955, 135 references.

No. 19—"Glove Dipping Techniques", May, 1955, 27 references.

No. 20—"Reclaim Rubber Cements", December, 1955, 19 references.

No. 21—"Permeability of Elastomers to Water and Water Vapor", December, 1955, 50 references.

No. 22—"The Permeability of Elastomers to Oxygen", December, 1955, 20 references.

No. 23—"Permeability of Elastomers to Air", December, 1955, 10 references.

No. 24—"Rubber Bearings", November, 1955, 20 references.

No. 25—"Isocyanate-Polyester Compounds", June, 1955, 117 references.

No. 26—"Continuous Vulcanization of Extrusions for Wire and Cable", July, 1956, 44 references.

No. 27—"Finishing of Small Molded Goods", August, 1956, 16 references.

No. 28—"Oil-Extended Rubbers", April, 1957, 117 references.

Kenplast Vinyl Plasticizer

► Kenrich Corp., Maspeth 78, N. Y., has introduced "Kenplast", a light-colored petroleum product useful as a plasticizer with vinyl resins. The company states that the product is exceptionally helpful in obtaining low temperature flexibility, having a pour point of —55°F. Kenplast may be used to replace ester plasticizers, such as DOP, and is useful in light-colored stocks as an economical extender. Kenrich advises that Kenplast is recommended in products where "Kenflex A" or "Kenflex N" is used in order to improve cold bend. It is not recommended, however, for wire coating which must meet UL specifications. Kenplast has a specific gravity of .90 at 60/60°F., and a viscosity of 55 (Saybolt seconds) at 100°F.

Named Assistant To President

► Robert Van Patten-Steiger has joined the New Jersey Rubber Co., Taunton, Mass., as assistant to the president. Before he joined the company Mr. Van Patten-Steiger served as a sales representative for Harwick Standard Chemical Co.

Goodrich Promotes Lynn

► R. Emerson Lynn, Jr., has been named manager of chemical engineering research at the B. F. Goodrich Research Center, Brecksville, Ohio. Dr. Lynn, who joined the Research Center in 1952 as a senior technical man, was graduated from Purdue University in 1942 with a B. S. degree in chemical engineering. He received his Ph. D. degree in the same field at the University of Texas in 1952. Dr. Lynn is a member of the American Chemical Society and the American Institute of Chemical Engineers.

Daubert Release Paper

► Development of a new release paper which can be used for interleafing rubber products, tapes, tile and other items having tacky surfaces, has been announced by the Daubert Chemical Co. of Chicago, Ill. The new sheet may be obtained with one or both sides treated, and is supplied in standard rolls 36 inches wide and 200 yards long. The paper will be slit or sheeted to order.

John W. Perloff

Joins Golden Bear Oil

► John Walton Perloff, formerly with Godfrey L. Cabot, Inc., has joined the Golden Bear Oil Co. as sales development manager of the Chemicals Division. This position was created by the accelerated expansion and diversification program of the company. After graduating from the University of Florida in 1936 with a B. S. degree in chemical engineering, Mr. Perloff worked as a research chemist in the rayon plant of the Tubize Chatillon Corp., Rome, Ga., as a control chemist in the Kraft Paper Mill Laboratory of the Southern Kraft Corp., Panama City, Fla., and as a process development engineer at the Owen-Corning Fiberglas Corp., Newark, Ohio. In 1943, he joined the B. F. Goodrich Chemical Co., serving for three years as process engineer in the GR-S polymer plant at Louisville, Ky., and three and a half years as group leader in the sales service laboratory of the Cleveland Laboratories. From 1949 to 1952, Mr. Perloff was head of the Plastics Rubber Group in the Technical Service Division of the Diamond Alkali Co., Painesville, Ohio. He then accepted a position as manager of the newly formed Plastics Chemicals Division of Godfrey L. Cabot, Inc. Mr. Perloff remained with Cabot until October of this year, when he joined Golden Bear Oil. He will make his headquarters at the company's main office in Los Angeles, Calif.

Goodrich Trailmaker Winter Tire

► B. F. Goodrich Tire Co., Akron, Ohio, has developed a new tubeless winter traction tire, said to have a "thick wide tread that puts more rubber on the road than any other winter tire". Called the "Trailmaker", the tire was designed for use on new cars with 14-inch wheels. According to the company, it has a deep, self cleaning tread that provides increased traction and skid resistance in deep snow or mud. Thousands of gripping edges are put into the tread with a special machine after the tire is cured. Made with Goodrich nylon cord, the new Trailmaker has a heavy carcass for long wear and added protection against road shock.

Connecticut Holds Outing

► A near-record number of members and guests, totaling 161, attended the Twelfth Annual Outing of the Connecticut Rubber Group held on September 7 at Grassy Hill Park, Derby, Conn. Members and guests participated in various games and sporting events, including softball, horseshoes, golf, etc. The Outing Committee consisted of Vincent P. Chadwick (chairman), James R. Boyle (vice-chairman), William H. Couch (treasurer) and Kenneth D. Champagne (assistant treasurer). The following members served on the committees named: *Softball Committee*—Al Simon, H. M. Montague, G. Jerolman, Warren Carter, Hank Rice; *Horseshoe Committee*—R. Potter, Ray Dudley, B. Fairbanks, R. Ward, Bud Stringer; *Golf Committee*—Al Murdock, George Sprague, Bill Maguire, F. Burger, Dan Doherty; *Egg Throwing Committee*—Bill Platt, Russ Sawyer, Carl Larson, Larry Driscoll, Bill Curtin, H. O'Conner; *Greeting Committee*—Charles Haynes, Al Schorr, Bill O'Brien, Dave McKean, Otto Lang, Emil Schwartz, F. J. Rooney, Jim Kineaon, Harley Flint. Prizes were awarded to the winners of the various games and sporting events.

Yokohama Celebrates Anniversary

► Yokohama Rubber Co., Yokohama, Japan, which twice survived almost total physical destruction, held a 10-day celebration in honor of its 40th anniversary in October. Celebrations were held at each of the firm's four plants, in Hiratsuka, Mie, Mishima and Ageo. Opening ceremonies were at the Hiratsuka plant, 24 miles west of Yokohama. Employees and guests heard addresses by S. Maeo, Japanese minister of International Trade and Industry, and K. Oyama, president of Yokohama Rubber. Also on the speaking program were George W. Vaught, a director of the B. F. Goodrich Co., and former vice-president, and H. E. Heilman, vice-president—sales of the International B. F. Goodrich Co. since its founding in 1917. Recognized today as one of the leading rubber companies in Japan, Yokohama Rubber was virtually destroyed by an earthquake in 1923 and by bombing in 1945.

Double Floform Thermax Production

► Thermatomic Carbon Co., a division of Commercial Solvents Corp. and R. T. Vanderbilt, Inc., has announced a new expansion which is expected to more than double the production of "Floform (pelleted) Thermax" by early 1958. Floform Thermax, packed in 50 pound bags, will ship and store in 25 per cent less space than powder, the company says, and may be shipped in bulk. A special process for making the dustless, free-flowing Floform Thermax was developed in Thermatomic's recently expanded Research and Quality Control Laboratories. While the major output of the Sterlington, La., plant will be converted to this type, Thermax and P-33 will continue to be available in powder for customers who require it.

M. S. Meyer

Appointed Managing Director

► M. S. Meyer, formerly sales director, has been named managing director of Goodyear-Great Britain, succeeding A. S. Bishop, who has been named chairman of the board. Elected to succeed Mr. Meyer is A. H. Pendree, former sales manager. Mr. Meyer has spent 27 of his 30 years with Goodyear in foreign service. His first overseas assignment was in 1930 as secretary of Goodyear-Germany, where he later served as assistant manager. In 1932, he was appointed manager of Goodyear-Poland. Following several other assignments, he returned to Akron in 1952 as manager of the Far Eastern Division and later served as manager of the Near Eastern and African Divisions. He was named sales director for Goodyear-Great Britain in 1954. Mr. Bishop joined the company in England in 1916. In the 1920's he visited Akron to learn about early pneumatic truck tires pioneered by Goodyear and he introduced them in English transportation. He became general sales manager of Goodyear-Great Britain in 1933, sales director in 1936 and managing director in 1954. Mr. Pendree has been with the Goodyear sales organization in Great Britain for 28 years. Starting as a general line salesman, he rose through several promotions to the top sales post in the English organization.

Latex Fiber Names Two

► Latex Fiber Industries, Inc., Beaver Falls, N. Y., has announced the appointment of A. G. Steinbrenner as manager of sales and production coordination and G. A. Pominville as acting plant engineer to succeed H. F. Greeney. Mr. Steinbrenner joined the company soon after it was formed in 1933. He has held various positions, the most recent being that of assistant to the sales manager. Mr. Pominville joined the company in 1945 as draftsman after attending the University of Detroit. He was later promoted to assistant to the plant engineer, a position he has held up to the present time.

Goodyear Chairman Foresees Synthetic Rubber Shortage

► In the latest of his series of notes on the American rubber industry, P. W. Litchfield, chairman of the Goodyear Tire & Rubber Co., advised the free nations of the western world to start catching up with the United States in the field of synthetic rubber. Unless other nations produce and consume more synthetic, a world shortage of rubber will develop in the 1960's and become increasingly acute with succeeding years, Mr. Litchfield said.

According to Mr. Litchfield, U. S. plants produce 89 per cent of the total world supply of synthetic and leads in both producing capacity and know-how. As a result, 63 per cent of the rubber consumed in America in 1957 will be man-made instead of tree-grown rubber. In contrast, he said, the rest of the world looks to synthetic for only 20 per cent of its total requirements.

Though this works out well for the present, Mr. Litchfield warned, the picture will begin to change within the next few years. "We will be in trouble unless consumption of synthetic in the rest of the world trebles by 1965. And the best way for these countries to do this is for them to build their own synthetic plants. If they need help—technical or financial—we should in our own self interest extend it."

The percentage of synthetic rubber used abroad should rise to 32 per cent in 1960 and to 41 per cent in 1965 in order to avoid the impending squeeze on the natural rubber supply. Mr. Litchfield said, "We simply must make the available supply of natural go farther." He feels that the current consumption pattern of 63 per cent synthetic and 37 per cent natural in the U. S. is approaching the limit as measured by product value and service.

"We should not go much farther with presently-available types of synthetic", Mr. Litchfield stated. "They (the other nations) can and should. And since the impending squeeze on natural will hurt them as it will hurt us, it's their move."

Mr. Litchfield noted that a corrective trend has already set in. Canada long ago created a plant to look after its own synthetic needs. In England, a new plant is under construction. Japan and Italy have plans for plants, West Germany has decided to expand its facilities and some of the Latin American countries are showing an interest.

"My concern", Mr. Litchfield concluded, "is with accelerating this trend, for the critical period where demand will exceed supply is fixed between 1960 and 1965, and will become more acute with each succeeding year."

Elects Executive Vice-President

► George F. Dixon has been elected executive vice-president and chief administrative officer of the Carlisle Corp., Carlisle, Penna. He succeeds the late Furber Marshall. Mr. Dixon will continue as president of Dart Truck Co., a subsidiary of the Carlisle Corp.

Coating Saves Warehouse Expense

► Outside rim storage, made possible by the use of a protective coating known as "Bond-A-Coat," has enabled the developer, the Metal Products Division of The Goodyear Tire & Rubber Co., to effect a considerable savings in warehouse expense. Floor space which would be required for the inside storage of an equal quantity of finished rims, now stacked out-of-doors, would represent an investment of more than two million dollars. The finish is effective against the ravages of rust and corrosion. More than 50,000 rims are shown in this photograph of a portion of the four acres of black top storage surface which surrounds the Metal Products plant.

Air Springs In Volume Production

► Goodyear Tire & Rubber Co., Akron, Ohio, has disclosed that the concern is now in volume production of automobile rubber air springs at the company's Industrial Products plant. The announcement followed news from Detroit that the new type rubber spring systems, which adjust automatically as loads change, will be offered as standard or optional equipment on some 1958 model cars, while other manufacturers are considering rubber springs for possible use on future models. The new rubber spring production program, Goodyear says, is the climax of years of advance planning plus the design and installation of completely new manufacturing and testing equipment, a program representing a multi-million dollar venture. The company has a large technical staff to coordinate design and development work.

To Construct New Laboratory

► Ernest F. Fullam, Inc., Schenectady, N. Y., has announced plans to construct a $300,000 Research and Development Laboratory in the Albany-Schenectady area of New York. The new laboratory will add 5800 square feet to present facilities which specialize in chemical-physical research and development and industrial consulting service. The building, said to be unique in construction, will overlook the Albany airport from a seven acre plot.

General Tire Appointments

► General Tire & Rubber Co., Akron, Ohio, has appointed Oliver G. Vinnedge, former vice-president of Sheller Corp. and general manager of the Dryden Division, as a vice-president in charge of the company's Industrial Products Division. Howard M. Garver, a long time associate of Mr. Vinnedge and assistant general manager at Dryden, has been named assistant general manager at General Tire. In his new assignment, Mr. Vinnedge assumes direction of sales and manufacturing of General's industrial products plant in Wabash, Logansport and Marion, all of Indiana, and the company's Welland, Ont. plant. The company's Wabash and Logansport facilities were formerly under the direction of vice-president Howard M. Dodge, who is assuming new duties with the parent company.

Merger Under Consideration

► Curtiss-Wright Corp., Wood Ridge, N. J., and General Aniline and Film Corp., New York, N. Y., have announced that they are considering a joint venture involving the production and marketing of chemicals used to produce synthetic materials and plastics. The plan would provide General Aniline & Film with an outlet for proprietary chemical formulations, and Curtiss-Wright with raw materials required in the manufacture of the firm's Curon and other plastic products.

Akron Holds Symposium On Rubber-to-Metal Adhesion

► The October 25th meeting of the Akron Rubber Group, held at the Sheraton Mayflower Hotel in Akron, Ohio, attracted some 800 members and guests who gathered to hear a symposium on "Rubber-to-Metal Adhesion." J. Hugh Macey (Goodrich Research) served as moderator. The panelists included Ralph Schmuckal (Ford), who spoke on "Challenge to the Rubber Industry;" Fred W. Gage (Dayton Chemical Products), who spoke on "Metal Surface Preparation;" Russell E. Sawyer (R. T. Vanderbilt), who addressed the group on "Adhesion Compounding Aspects;" Peter J. Larsen (Lord Mfg.), who chose as his topic "Adhesion Test Methods," and Howard H. Irwin (Marbon Chemical), who spoke on "Current and Future Trends in Bonding."

Sheldon Nicol (Goodyear), the new chairman of the group, presided over the meeting. Mr. Nicol took office only recently following the resignation of Harold Catt (Goodrich). Mr. Catt found himself unable to continue in the office because of a work reassignment to the West Coast area. Mr. Nicol, previously vice-chairman of the group, has appointed K. R. Garvick (Mansfield Tire) as assistant to the chairman. Mr. Garvick is a past-chairman of the Akron Rubber Group.

In brief remarks to the group, Mr. Garvick made an appeal for group members to join the Division of Rubber Chemistry of the American Chemical Society. John Mackay (Phillips Chemical), head of the Auditing Committee, reported that an audit of the group's financial affairs indicated that all was in order. George Popp (Phillips Chemical), treasurer of the organization, announced that $9,160 was in the group treasury. L. A. Anderson, chairman of the Membership Committee, stated that there are now 1,332 members of the Akron Rubber Group.

Harry M. Brubaker (Witco), chairman of the Scholarship and Education Committee, advised that 187 persons are now taking the rubber technology course sponsored by the group at the University of Akron. He also spoke of the status of the group scholarship program. Mr. Brubaker, past-chairman of the group, was honored at the meeting and awarded a plaque. Harold Catt was similarly honored.

In addition to the panel discussion and the question-and-answer period which followed, the meeting included a dinner and a talk by Bob Feller, former star pitcher of the "Cleveland Indians." Mr. Feller was introduced by E. I. Bosworth (Columbian Carbon).

Columbian Revises Data Sheet

► Columbian Carbon Co., 380 Madison Ave., New York 17, N. Y., has announced the revision of its property sheet describing various grades of carbon black and other materials available to the industry. Carbon blacks, bone blacks, iron oxide colors and black dispersions are covered. Copies of the four-page folder may be obtained by writing the company.

ISA Meeting Hears Zimmer

► A symposium on "Rubber and Plastics" held recently in Cleveland, Ohio, by the Instrument Society of America, featured an interesting paper on "Instrumentation for the Rubber and Plastics Industry" by R. S. Zimmer, vice-president of the Industrial Gauges Corp., West Englewood, N. J. In his paper, the author first set forth the premise that automation is popularly considered the substitution of electronic computers for the human brain or judgment. Electronic means of replacing the human senses are equally important, he declared. The author went on to describe the electronic measuring and control devices actuated by electromagnetic energy—from infra-red through the optical and into the X-ray range. With their ability to "see" with a much wider range of the spectrum and with their electronic amplification, these devices are far more effective than the human senses, Mr. Zimmer stated. The author then cited a number of applications of instrumentation, such as dimensional control in calendering, extrusion of sheet and coated wire, tubing, tire treads, and in-flow mixing.

USDA Conducting Research Program

► U. S. Department of Agriculture has announced that it is undertaking a new research program to study the effects of various synthetic resin and rubber latex emulsions upon cotton. A contract for this research has been negotiated between the Department's Agricultural Research Service and the Clemson Agricultural College School of Textiles at Clemson, S. C., where the work will be done. This study is a part of a continuing program to develop new uses for cotton and to make cotton fabrics more suitable for present uses. Selected compounds will be used to learn if they will impart desirable new qualities to cotton. Preliminary analysis shows that some of these compounds can improve cotton's resistance to water, abrasion, weathering and soiling. The research will be directed by James H. Langston, professor of textile chemistry and dyeing at Clemson and Carl Hamalainen of the Cotton Chemical Section at USDA's New Orleans Laboratory.

Griptex Rug Life-Guard

► Adhesive Products Corp., 1660 Boone Ave., New York, N. Y., has developed the "Griptex Rug Life-Guard" to prevent rug skidding. A liquid rubber, the new product also stops fraying and may be used for repair work. Applied by brush or spray, Griptex Rug Life-Guard dries to form a strong rubbery film which anchors itself to the rug and forms a non-skid underlay. Said to be moth and fire resistant, Griptex Rug Life-Guard may also be used for such repairs as patching burned or stained areas, attaching fringe, reinforcing backs of rugs, making edges and joining seams. It dries tack-free and remains permanently flexible, according to the company. Rugs treated with this material may be washed or dry cleaned.

Harvey Firestone Forecasts Healthy Economy in 1958

► The nation's general economy is strong and healthy, despite readjustments in some areas, and the outlook for most basic industries for the final quarter of 1957 is encouraging, Harvey S. Firestone, Jr., said on his recent departure for Europe where he will inspect company installations. The 1958 outlook for the tire industry, in particular, is good, Mr. Firestone said, with studies indicating new sales records possible.

Sales of tires will reach an all-time high next year, when 111,000,000 are expected to be marketed, said the chairman of Firestone Tire & Rubber. This would be 2.8 per cent higher than the now anticipated record 1957 sales of 108,000,000 tires. "Replacement tire sales this year are expected to amount to 56,000,000, a new record, and we believe replacement tire sales will climb to another new high of 58,700,000 in 1958", Mr. Firestone said.

"The general economy is aided by a steady population growth, record personal income, higher than ever standards of living, and industry expansion," Mr. Firestone said. He pointed out that there were signs that business will be very active during the final quarter of 1957. "There has seldom been a period when there were more new developments, new products, new inventions, and new scientific advances," Mr. Firestone said. "These factors contribute greatly to the economy and they are proof of the alertness of American business and industry."

Mr. Firestone said that advances in the rubber industry were especially notable. "Rubber manufacturers spent more than $200,000,000 on new plants and equipment in 1956 and there are indications this figure will rise to a new record in 1957," he said. Firestone is putting five new major plants or expansions into operation during 1957. These include tire plants in Havana, Cuba, and Manila, Philippine Islands; a butadiene plant in Orange, Texas; an Airide plant in Noblesville, Ind., and a synthetic rubber plant expansion in Lake Charles, La.

Mr. Firestone said his firm's new butadiene plant was producing at an annual rate of 40,000 tons a year, a substantial portion of the raw material for synthetic rubber being manufactured at Lake Charles and Akron, Ohio.

General Buys Castle Rubber

► General Tire & Rubber Co., Akron, Ohio, has announced the acquisition of the Castle Rubber Co. of Butler, Penna. According to William O'Neil, General Tire president "The acquisition of Castle Rubber Co. brings to General a group of entirely new products and enables us to offer a more comprehensive line of industrial rubber goods." Castle produces large mechanical rolls and other wrapped mechanical goods, specially designed oil well snubbers and other rubber products made to customer specification and chemical linings for containers other than food. The company was formed in 1926 and employs 375 persons at its Butler plant.

George W. Smith

Named New England District Manager

► George Warren Smith has been named to succeed W. H. Zillessen, who recently retired as manager of the New England district of the Elastomer Chemicals Department of E. I. du Pont de Nemours & Co., Inc. Mr. Smith joined DuPont in 1944 as a technical representative of the Rubber Chemicals Division in Boston. In 1952, he became assistant manager of the New England district of the Rubber Chemcals Division and retained that post when the division became the Elastomer Chemicals Department in January of this year. A graduate of the Massachusetts Institute of Technology, Mr. Smith worked for the Hood Rubber Co., Stanley Chemical Co., Allied Chemical and Dye Corp., and the Organic Chemical Section of the War Production Board before joining DuPont. He is former chairman of the Boston Rubber Group and is a director and immediate past-president of the Chemical Club of New England.

Mr. Zillessen joined the Newport Chemical Corp. in 1923 and became New England district sales manager of DuPont's Organic Chemicals Department when that firm was purchased by DuPont in 1931. He became New England manager of the Department's Rubber Chemicals Division in 1955, remaining in Boston when the Dyes and Chemicals Division moved its offices to Providence.

Borden Appointments Announced

► Chemical Division of the Borden Co., New York, N. Y., has announced the appointment of S. Robert Sweet and John A. Bushee to the company's Coatings and Adhesives Department. Mr. Sweet, who formerly handled technical sales in the Midwest for Borden, has been assigned to the Department's sales staff. He will handle Placco brand building materials in the Philadelphia area. Mr. Bushee, who was formerly with General Latex Chemical Corp., where he developed various latex compounds, has been assigned to the company's latex laboratory in Peabody, Mass.

Forms Technical Development Division

► National Adhesives Division of National Starch Products, Inc., New York, N. Y., has announced the consolidation of the Development and Technical Service Departments. The new Technical Development Division will be based at the Plainfield, N. J., laboratories. William Sederlund has been appointed manager, packaging adhesives, technical development, and he will be assisted by Carl Witzmann, who will have primary responsibility for resin emulsions and hot melt products. Richard Weidener will have primary responsibility for vegetable-based materials, dry dextrines and extended resins. Jules Sirota has assumed responsibility for the investigation of longer range problems and projects. Chris Fazioli has been named midwest manager, Adhesives Technical Development with headquarters in Chicago. A new group has been set up to intensify National's interest and participation in the field of new product development. Sam Gold has been appointed manager, technical market development, with headquarters at Plainfield. He will be assisted by William Blake as supervisor for the Eastern Adhesives Division; Robert Pett, Midwest Adhesives Division, and Joe Ducharme, who will coordinate all adhesives technical development work on the West Coast. Paul Weitz has been appointed administrative assistant and will handle administrative and public relations functions for the group.

SEC Concludes Bellanca Hearing

► The Securities and Exchange Commission has concluded its hearings on the financial affairs of the Bellanca Corp. and must now decide whether the company's stock should be banned from the American Stock Exchange or suspended from trading. Meanwhile, it has been reported that President Sidney L. Albert and two Bellanca directors, Joseph R. Hewitt and S. R. Arsham, have resigned their posts with the company. When Mr. Albert originally entered the Bellanca picture in February, 1955, he traded the assets of L. Albert & Son for 1,070,000 shares of Bellanca common. It is now estimated that Mr. Albert holds some 100,000 shares of Bellanca common. Arthur K. Rothschild, vice-president and treasurer of Bellanca, states that the L. Albert & Son Division of the company is the only company division currently in operation. He stated that three plants are running in Trenton, Akron and Los Angeles.

Announces Epocast 126

► "Epocast 126", a new solventless vinyl adhesive said to aid the application of colorful vinyl films and sheets to construction materials, has been added to the line of Furane Plastics, Inc., Los Angeles, Calif. Specifically developed for use with vinyl compounds, the new material permits facing of construction materials, such as steel, aluminum and others, with a veneer of decorative and colorful plastic. Epocast 126 permits the bonding of rigid as well as most semi-rigid sheets to concrete, metals and other materials.

James L. Weaver

Appointed Trenton Representative

► Harwick Standard Chemical Co. of Akron, Ohio, has announced the appointment of James L. Weaver as special sales representative in the Trenton, N. J., area. Mr. Weaver will assist R. J. Salyerds, vice-president of Harwick's New Jersey subsidiary, in area sales development and warehouse management. Mr. Weaver joined the Harwick organization in 1948 and served in an administrative capacity at the Akron office until his appointment to the sales staff and assignment to the Trenton office. He was educated in business administration at Ohio State University.

Named Manufacturing Manager

► Walter E. Head, formerly manager of the B. F. Goodrich Co. tire plant in Miami, Okla., has been appointed manager of manufacturing for the B. F. Goodrich Tire Co., with headquarters in Akron, Ohio. Mr. Head joined Goodrich as tire builder in 1924, later becoming industrial engineer and manager of the industrial Engineering Department in the Akron plant of the Tire Division. He was transferred to California in 1939 as production superintendent of the Los Angeles plant and named factory manager in 1942. In 1945, he was named manager of the newly-built Miami plant.

Named Field Representative

► J. L. Jenkins has been named special field representative for the Chemical Division of the Goodyear Tire & Rubber Co., Akron, Ohio. With headquarters in Cleveland, Mr. Jenkins will service the paint, textile and paper processors located in the mid-central states. Mr. Jenkins joined Goodyear this year with more than twenty years of experience as production supervisor for a textile concern, and as sales and sales service representative for a chemical equipment house. Mr. Jenkins underwent preliminary training with the Chemical Division's Coatings Department prior to his field assignment.

Detroit Holds Panel On New Plastics Developments

► About 175 members and guests of the Detroit Rubber and Plastics Group attended the October 4th meeting held at the Detroit Leland Hotel, Detroit, Mich. The meeting program consisted of a panel discussion on "New Plastics Developments in the Automotive Industry." N. J. Rakas (National Automotive Fibers) served as moderator for the discussion. Speakers included Dr. A. J. Carter (Chrysler), who spoke on "Heat Ducts, Polyurethane Foams and Crash Pad Materials." John Mickey (Ford), discussed "Sealers, Sound and Dust Seals."

Harry McGowan (Bakelite), chose as his topic, "Linear Polyethylenes," while John White (Fisher Body) spoke on "Vinyl and Mylar Trims." John Young (DuPont) discussed "Plastic Gears and Bearings." In his talk, Mr. McGowan stated that the advent of a low pressure catalytic process for making polyethylene has developed a plastic material with new properties opening up new fields of application.

The speaker outlined the physical and mechanical properties of low pressure polyethylene and noted that its many desirable characteristics make it suitable for many automotive applications. He also touched on the question of cost, noting that low pressure polyethylene enters the market priced above conventional polyethylene, but priced considerably less than other competitive materials.

In his talk on vinyl and Mylar, Mr. White stated that vinyl was adopted for limited automotive application in 1948 and since that time has grown to the point where it is now an integral part of seat coverings, door and quarter panels, headlining, trims, floor and trunk coverings, convertible top materials, molded knobs, grommets, etc.

Vinyl foams, he said, are today used in a limited way for padding. Mr. White cited those technical factors which make vinyl suitable for automotive application. In speaking briefly of Mylar, Mr. White declared that its future in the rubber industry seems to be assured in that its impact strength is at least twice that of any currently available commercial film.

To Exchange Technical Data

► Catalin Corp. of America, New York, N. Y., and Cie Centrale Rousselot, Paris, France, will exchange technical information and "know-how" under the terms of a five-year license agreement, which provides payment for Catalin on a royalty basis. Catalin will disclose to Rousselot its formulas and technical information pertaining to the manufacture of solid one-stage and two-stage phenolic resins for adhesives, bonding, molding and foundry uses. The agreement permits Rousselot to manufacture in Sweden, Switzerland and European countries which are now signatories of the North Atlantic Treaty Organization. Rousselot will supply Catalin with information on any processes the French company develops in the areas covered.

Philip G. Connell, Jr.

Promoted by Cyanamid

► Philip G. Connell, Jr., has been named assistant general manager for the Pigments Division of the American Cyanamid Co., New York, N. Y. Mr. Connell, formerly manager of the Rubber Chemicals Department for the company's Organic Chemicals Division in Bound Brook, N. J., has been with Cyanamid since November, 1946. He has served as a development engineer in process improvement and new product development, and in sales capacities for the Intermediates and Chemicals and the Intermediates and Rubber Chemicals Departments. A native of Chicago and a chemical engineering graduate of Princeton, Mr. Connell served for three years on destroyer duty with the Navy during World War II and had risen to the rank of lieutenant (Junior Grade) when he left the service.

Labor Notes

► The United Rubber Workers Union, AFL-CIO, has been defeated 288 to 5 in a recertification election conducted by the National Labor Relations Board at the O'Sullivan Rubber Corp., Winchester, Va. In an election held about 18 months ago, URW was certified by the NLRB as bargaining agent. Later, the union went on strike to back up contract demands. Since the walkout, about 17 months ago, the company has hired new personnel. Under the Taft-Hartley Law, the company has the right to ask for a new election a year after a union is certified, however, the striking workers are ineligible to vote in this election. Referring to the 300 strikers ineligible to vote, L. S. Buckmaster, URW international president, said: "No group was more concerned with the outcome, but, ironically, it was this group which was denied the right of the ballot. The example of how this law can be used to fire workers, some with as much as 30 years' service, should spur us all on to do something to bring a degree of fairness in the law. The strike is still on and peaceful picketing of the plant is continuing . . . ."

Thiokol Club Hears Williams on Gel Formation

► Approximately 200 members and guests of the Thiokol Technical Club attended the October 10th meeting held at the laboratories of the Thiokol Chemical Corp. in Trenton, N. J. Principal speaker at the meeting was Dr. Ira R. Williams, director of research of the J. M. Huber Corp., who chose as his topic, "Influence of Gel Formations on SBR Rubber."

In addition to outlining how gel is evaluated, Dr. Williams pointed out that gel content is either beneficial or detrimental, depending on the properties desired. High gel content is not desirable when a maximum in physical properties is sought. On the other hand, he stated, certain gel contents are helpful in obtaining improved processing characteristics. Effects of various black and non-black pigments on gel formation, effects of chemicals, time and temperature were illustrated by Dr. Williams through the use of charts.

Dr. S. M. Martin, vice-president of the Thiokol Chemical Corp., opened the meeting and the speaker was introduced by O. M. Hayden (DuPont). A social hour and dinner preceded the technical portion of the meeting.

Diamond Alkali Names President

► Raymond F. Evans, formerly chairman and chief executive officer, has been named president of the Diamond Alkali Co., Cleveland, Ohio, to succeed John A. Sargent, who has resigned as president and director. The board of directors also elected A. H. Ingley, former senior vice-president, to the newly created post of executive vice-president. Mr. Evans joined Diamond Alkali at the Painesville, Ohio, plant as a production worker in 1931. He served in a number of departments and was subsequently transferred into research. During World War II, Mr. Evans was instrumental in organizing Diamond Magnesium Co. and served as its president during operation of the government's magnesium plant at Painesville. Afterwards, he was promoted to vice-president and general manager of the company's Painesville plant.

Mr. Ingley was named senior vice-president in August and a director in April. Previous to this, he was vice-president of manufacturing for nine years. He joined the company as a traffic clerk in 1920 and later became traffic manager. In 1925, he was promoted to general manager of the Standard Portland Cement plant at Painesville, and was then appointed vice-president of Diamond Magnesium in 1942, becoming president two years later. Mr. Ingley returned to the parent organization in 1945 as director of business relations and was named general manager of the Painesville plant in 1946. He was promoted to vice-president of manufacturing in 1948.

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80 Million Tires a Year Foreseen by Humphreys

► Tire dealers in this country will be selling 80,000,000 passenger tires a year in a decade, a 45 per cent increase over this year's business, H. E. Humphreys, Jr., chairman of the board of the U. S. Rubber Co., predicted recently. Mr. Humphreys spoke to more than 800 U.S. Royal tire distributors who attended the annual convention of the National Tire Dealers and Retreaders Association.

The U.S. Rubber executive said truck and bus casings should add another 11,000,000 units to the dealers' 1967 volume. The immediate outlook was also good, he added, with replacement passenger tire business for this year at a record level of 55,000,000 units. Next year's business should top that figure by about 1,000,000 units, he declared.

Mr. Humphreys said the replacement tire business would enjoy this expansion despite the fact that tire quality is continually improving because the nation is in a period of dynamic growth. By 1967 the nation's population he pointed out, would total about 200,000,000 persons.

"To meet the needs of this greater population and to keep up with the advancing standard of living, American industry will produce more goods," Mr. Humphreys said. "In the next 10 years our gross national product will increase close to 50 per cent to reach a total of about $600 billion." This means a sharp increase in motor transport of goods from factory to consumer, with consequent benefits to the replacement tire business, he said.

"The increase in personal income will keep pace with the increase in gross national product," Mr. Humphreys declared. "In addition, there is no doubt that most people can expect to have more leisure time. And, the nation's highway building program will add many more miles of better roads. Therefore we can expect more people to have more automobiles and drive them greater distances. We estimate that passenger car registrations will reach 70,000,000 by 1967. That will be nearly 25 per cent more cars than there are on the road today."

The rubber official warned however, that this "bright future" was not going to be handed to the tire industry on a silver platter. "The opportunity is there, but we shall have to work for it," he declared. It is up to tire manufacturers and their dealers, he said, to stay tuned to trends in modern living and modern business methods, to meet the needs of the consuming public and to keep pace with developments in automobile and truck design.

Sun Buys Ansbacher-Siegle

► Sun Chemical Corp. has signed a contract to buy the Ansbacher-Siegle Corp. for 225,000 shares of Sun Chemical common. Directors of both companies have approved the contract, which is subject to Sun's stockholder approval at a special meeting scheduled for November 29. Ansbacher-Siegle will operate as a division of Sun Chemical under its present management.

Coming Events in the Rubber Industry

Nov. 21. Quebec Rubber and Plastics Group.

Dec. 1-6. A.S.M.E. Annual Meeting, Hotel Statler, New York, N. Y.

Dec. 3. Buffalo Rubber Group, Xmas Party.

Dec. 5. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Dec. 6. Detroit Rubber & Plastics Group, Xmas Party, Sheraton-Cadillac Hotel, Detroit, Mich.

Dec. 10-11. Society of the Plastics Industry, Sheeting and Coated Fabrics Division Conference, Commodore Hotel, New York, N. Y.

Dec. 13. Boston Rubber Group, Xmas Party, Somerset Hotel, Boston, Mass.

Dec. 13. New York Rubber Group, Latin Quarter, New York, N. Y.

Dec. 14. Southern Ohio Rubber Group, Winter Meeting, Miami Valley Golf Club, Dayton, Ohio.

Dec. 20. Chicago Rubber Group, Xmas Party, Morrison Hotel, Chicago, Ill.

Jan. 15, 1958. Washington Rubber Group.

Jan. 16, 1958. Quebec Rubber and Plastics Group.

Jan. 24, 1958. Akron Rubber Group, Sheraton-Mayflower Hotel, Akron, Ohio.

Feb. 13, 1958. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

Feb. 18, 1958. Washington Rubber Group.

Feb. 21, 1958. Connecticut Rubber Group.

Feb. 21-22, 1958. Southern Rubber Group, Houston, Texas.

Mar. 20, 1958. Quebec Rubber and Plastics Group.

April 10, 1958. Fort Wayne Rubber & Plastics Group, Van Orman Hotel, Fort Wayne, Ind.

April 11, 1958. Akron Rubber Group, Spring Meeting, Sheraton - Mayflower Hotel, Akron, Ohio.

April 16, 1958. Washington Rubber Group.

April 17, 1958. Quebec Rubber and Plastics Group.

May 14 - 16, 1958. Division of Rubber Chemistry, A.C.S., Spring Meeting, Netherlands Plaza Hotel, Cincinnati, Ohio.

May 21, 1958. Washington Rubber Group.

May 23, 1958. Connecticut Rubber Group.

June 20, 1958. Akron Rubber Group, Summer Outing, Firestone Country Club, Akron, Ohio.

June 22-28, 1958. A.S.T.M. Annual Meeting, Hotel Statler, Boston, Mass.

Sept. 6, 1958. Connecticut Rubber Group, Summer Outing.

Sept. 10-12, 1958. Division of Rubber Chemistry, A.C.S., Fall Meeting, Hotel Sherman, Chicago, Ill.

Nov. 14, 1958. Connecticut Rubber Group.

Nov. 30-Dec. 5, 1958. A.S.M.E. Annual Meeting, Hotel Statler, New York, N. Y.

To Build Russian Tire Factory

► Five British companies, which have banded together as a firm, have announced that they are building a tire factory in the Soviet Ukraine for the Soviet Union at a cost of $21 million. Known as Rustyfe, abbreviation for Russian Tire Federation, the companies are negotiating for another contract to build the Russians a rubber processing plant, current reports say. Dr. J. G. Mackay, a director of Rustyfe, said the Russians had agreed to pay in pounds sterling for the factory and machinery which would be built by a number of companies in Britain and installed at Dnepropetrovsk.

To Manufacture Hobbs Winders

► Hobbs Manufacturing Co. of Worcester, Mass., which introduced the German-made Hobbs-Alquist line of winders to the U.S. in 1953, is now manufacturing the line in their Worcester plant. Wide demand for these winders and the need for certain improvements to accommodate American procedures, lay behind the company's decision to produce the winders in this country, company officials stated. The American-made line features improved design, better torque control, and better tension curve, the company states. Also, the manufacturer points out, servicing of the units will be facilitated.

Names in the News

Dr. W. J. Clayton has been named vice-president of consumer products, research and development and **Norman Allen,** a vice-president of industrial products sales and advertising for the International Latex Corp.

Dr. Clarence A. Stiegman has been named technical director and **Dr. J. Howard Brown,** general manager of Niagara research and development for the Hooker Electrochemical Co.

Robert R. Daly has been named president of Miracle Adhesives Corp.

Charles H. Churchill has been appointed executive vice-president and general manager of Pacific Polymers, subsidiary of American Latex Products Corp.

M. Clark Wakefield, who was previously with the Titanium Pigments Division of the National Lead Co., has joined the Chemical Division of the Borden Co. as Midwest district sales manager of the Polyco-Monomer Department.

Richard S. Cass and **William H. Crandell** have been admitted to partnership in the Frederick S. Bacon Laboratories, Watertown, Mass.

A. L. Freedlander, chairman of the board of Dayton Rubber Co. and internationally known as a pioneer in merchandising American "know-how" to overseas rubber firms, has been named a Knight of the Royal Order of St. Olaf, the highest honor Norway bestows upon a civilian.

Emory D. Seles, who was formerly with the Socony Paint Products Co., has joined Columbian Carbon Co.

A. K. May, formerly sales manager of the Jefferson Chemical Co., has joined Antara Chemicals Sales Division of General Aniline & Film Corp., as manager of ethylene chemical sales.

Robert W. Woollen, who joined the general office staff of the company on January 1, 1957, has been elected assistant treasurer of Petroleum Chemicals, Inc.

Selwyn R. Mather, formerly with the U. S. Rubber Co., has joined the Research & Development staff of the Richardson Co., to supervise the development of molded products and molding compositions.

R. P. Trauth, has been named manager and **L. Strauf,** sales manager, for the Chemical Division of Darling & Co.

Bert S. Hough, has been named Midwestern District manager in the newly opened Midwestern district office of the Monarch Rubber Co. which is located in Chicago, Ill.

George P. Towle, formerly executive vice-president and general manager of Sturtevant Mill Co., Dorchester, Mass., has been appointed president of the company, succeeding **William T. Doyle,** who has been named chairman of the board of directors.

Dr. James C. Kirk, previously research supervisor for the Petrochemicals Research Division of the Continental Oil Co., has been appointed director of research for Petroleum Chemicals, Inc.

J. R. Carlson, previously eastern regional manager, has been appointed to the newly created position of sales manager for the Jefferson Chemical Co., Inc., while **P. R. Monaghan,** formerly manager of the company's Technical Service Division, has been named regional manager for the eastern area.

John T. Castles, who was formerly manager of rubber market development, has been appointed sales manager for the Silicone Products Department of the General Electric Co., succeeding **Jerome T. Coe,** who has become the Department's marketing manager.

Dr. David Bandel, previously manager of the Chemical Research Division and special technical assistant to the vice-president of the Commercial Development Division for American Machine & Foundry Co., has been appointed associate technical director of Tracerlab, Inc., succeeding **Dr. William Tittle,** who has accepted a full professorship at Southern Methodist University, where he will develop a program on Reactor Engineering.

Robert L. Means, former assistant to the vice-president in charge of the Container and Chemical Specialties Division of the Dewey & Almy Chemical Co., has been appointed to the newly-created position of product sales manager for compound-applying machinery.

Henry C. Heine, who has had 18 years' sales experience with the rubber industry, has been appointed sales manager of the Hamilton Rubber Manufacturing Corp.

John U. Wolter has been named resident sales representative in the Michigan Alkali Division of the Wyandotte Chemicals Corp., with headquarters in the company's western district offices in Chicago.

H. D. Tompkins, vice-president of the Firestone Tire & Rubber Co., has been re-elected chairman of the Inter-Industry Highway Safety Committee.

Joseph Z. Sack has been appointed to the newly-created St. Louis sales territory of the Fatty Acid Sales Department of Emery Industries, Inc.

H. William Peterson, formerly district supervisor in the Middle Atlantic States area, has been named assistant manager of the Alcohols and Chemicals Division of Enjay Co., Inc.

Joseph H. Ehrhardt, previously sales manager for DuBois Plastic Products, Inc., has been named technical product development engineer at Gary, Ind., for the Marbon Chemical Division of Borg-Warner Corp.

John Sutton, who has been serving as plant 4 engineer since 1954, has been named manager of engineering for the Adhesives Division of B. F. Goodrich Industrial Products Co.

Martin E. Conroy, formerly associated with the W. K. Kellogg Co. in Jersey City, N. J., on the development of Kel-F Elastomers, has joined the Research and Development Division of the Olin Mathieson Chemical Corp. at Niagara Falls, N. Y.

Joseph W. Gallagher, who has been associated with sales activities in related fields for ten years, has been appointed manager of marketing for the Special Products Division of the Lord Manufacturing Co.

R. S. Wilson, executive vice-president in charge of sales, has been presented with a service emblem commemorating 45 years of continuous association with the Goodyear Tire & Rubber Co.

F. Russell Cashner has been named plant manager of the Cleveland plant for Industrial Rayon Corp. to succeed Dr. Galo W. Blanco, who retired recently.

Dr. J. F. Downie Smith, dean of engineering at Iowa State College for the last 10 years, has been elected a vice-president and head of the Central Research and Development Division for the Carrier Corp., while **Walter A. Grant,** a vice-president since 1953, has been named coordinator of all development engineering activities.

Francis J. Sergeys, formerly general manager of chemical products research and development for the Ethyl Corp., Baton Rouge, La., has been appointed vice-president in charge of development for the Research and Development Division of W. R. Grace & Co.

Robert D. Smith has been named vice-president and general manager for Mystic Adhesive Products, Inc.

Paul Brna has been promoted to district sales manager of the Mid-West Division, with headquarters in Chicago, for Rhodia, Inc., and **Frank Ball** has been appointed sales representative for the company's Mid-West Division.

Maurice S. Letourneau, technical sales representative for the Polyco-Monomer Department in the Chemical Division of the Borden Co., has been transferred from the New England area to Greenville, S. C., and will cover North Carolina, South Carolina and Virginia.

NIC Lists Scientific Problems

► A new publication entitled "Inventions Wanted by the Armed Forces" has been issued by the National Inventors Council, U. S. Department of Commerce, Washington 25, D. C., in cooperation with the Army, Navy and Air Force. The publication lists scientific problems that might be solved by the American rubber and plastics industries. A major problem to be approached by industrialists is the development of a solid or semi-solid material to replace the water and oils now used in hydraulic systems. According to NIC, very soft rubbers come close to possessing the universal stress properties of a fluid, but military scientists seek something still better.

Another government requirement is the development of light, flexible hose suitable for handling red fuming nitric acid. Rubber products with improved aging characteristics are also listed. The report states that the Armed Forces are required to store vehicles for long periods of time which subjects rubber components to deterioration from ozone and other elements in the atmosphere. Synthetic rubber elastomers suitable for use in pneumatic tires which would have improved hysteresis properties over government Rubber Type S are also itemized. Also desireable would be the introduction of new and improved plastic materials, techniques and methods of application to aircraft to improve strength, reduce weight and cut maintenance and production costs of structures and components. NIC states that industry can also help to bring about production of aircraft tires manufactured solely of synthetic materials for the purpose of reducing costs and requirements for strategic materials.

Named Geigy Representative

► Roy E. Slipiec has been named midwest sales representative of Geigy Industrial Chemicals, Division of the Geigy Chemical Corp., Ardsley, N. Y. His sales headquarters are located in Chicago, Ill. Mr. Slipiec attended Wright Jr. College, the University of Illinois and Roosevelt University, of which he is a graduate. He was formerly associated with the Gallowhur Chemical Corp., Ossining, N. Y., and the Movidyn Corp., Chicago, Ill. Mr. Slipiec is a veteran of World War II, during which he served with the Army Medical Corps in the South Pacific. He holds a commision with the U. S. Health Service.

Named National Aniline President

► National Aniline Division of the Allied Chemical and Dye Corp., New York, N. Y., has announced the appointment of Albert E. Cleghorn as president, succeeding Donald G. Rogers, who is retiring after 42 years service with Allied Chemical and its predecessor companies. Mr. Cleghorn joined Allied Chemical in 1933 and has been executive vice-president of the National Aniline Division since 1954.

Goodyear Working On Two-Place Version Of Inflatoplane

► Having successfully completed the one-place inflatable airplane development program for the Office of Naval Research (ONR), Goodyear Aircraft Corp. is now under contract for a program expansion to include a two-place version. The two-place Inflatoplane (see artist's concept) will basically feature side-by-side seating, increased horsepower and improved performance. The program is jointly sponsored by the Office of Naval Research and the U. S. Army. The craft's one-piece wing, tail assembly and enclosed cockpit will be made of Airmat (two walls of rubberized fabric connected by nylon threads) a product of the Goodyear Tire & Rubber Co. The cigar-shaped fuselage will be made of rubberized fabric.

Study Elastic Properties Of Solids

► A final report of a six-year study of the dynamic elastic properties of solids has been released by the Office of Naval Research. Available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., the report gives the results of research concerned with the determination of the elastic modulus and the internal friction of solids under alternating stresses. Study was divided into two phases: measurements on metals, mostly single crystals, and measurements on plastics and elastomers. Report No. PB 121701 deals with observations made over a wide temperature range for all materials. Frequency range was wide for the plastics, but limited for metals. Entitled *Dynamic Properties of Solids, Final Report*, by T. R. Cuykendal and H. S. Sack, Cornell University for the Office of Naval Research, this study of elastic properties of single metal crystals was aimed at expanding knowledge of the role played by dislocations in the anelastic behavior of metals. Data on the dynamic elastic properties of elastomers and plastics augments limited literature on the subject which was started in 1947. In this study, which was published in November, 1955, specific plastics and elastomers examined were natural and synthetic rubber, vulcanized rubber, rubber under static stress, isobutylene, polymethylacrylate, Teflon and cellulose acetate. Special studies were made of creep under fast loading, beta brass and ultrasonic velocities in liquids. The 115 page volume is priced at $3.00.

Borden Completes New Unit

► Polyvinyl Chloride Department of the Chemical Division of the Borden Co., New York, N. Y., has completed construction of a modern, one-story office and laboratory building in Leominster, Mass. The new facility will be operated in conjunction with the polyvinyl chloride resin plant opened by the company at the same location last year. The laboratory is divided into three sections: fundamental polymer research and development; semi-pilot operations, and technical service work on finished product processing and evaluation. The main objective of the new plant is to develop and improve polymers and copolymers of vinyl chloride, according to the company. Offices in the new building will house sales and order, purchasing and general accounting departments and management personnel for both the plant and laboratory.

Pittsburgh Coke Names Finney

► Industrial Chemicals Division of the Pittsburgh Coke and Chemical Co., Pittsburgh, Penna., has appointed Edward E. Finney as sales representative in eastern New Jersey, Brooklyn and Long Island, N. Y. He had formerly been associated with Goodyear Tire and Rubber Co. and Naugatuck Chemical Co. A graduate of Yale University, Mr. Finney holds a B. S. degree in industrial administration. He is a Navy veteran of World War II and is a member of the Society of Plastics Engineers, the Rubber Group and the Yale Club of New York City.

Canadian News

► The board of directors of Firestone Tire & Rubber Co. of Canada, Ltd., have elected William H. Funston, former president, as chairman of the Canadian company. T. M. Mayberry, former executive vice-president and treasurer, has been appointed president. R. I. Raycroft, former general sales manager, has been named vice-president, sales. The board of directors announced that these and other changes in executive personnel were made to "enlarge the executive management to meet the increasing business opportunities of the years ahead."

In other executive changes, Mr. Funston announced the election of D. R. Caskie, formerly assistant treasurer, to the office of treasurer. S. F. Palmer, formerly manager, manufacturers sales, has been appointed assistant to the president — a newly created position. F. Sommers succeeds Mr. Palmer as manager, manufacturers sales.

Mr. Funston has been associated with Firestone for 33 years. He started his career as purchasing agent of Firestone Steel Products Company in Akron, Ohio. He was elected president of Firestone of Canada in 1932.

Mr. Mayberry, born and educated in Stratford, Ont., becomes the first Canadian-born president of Firestone of Canada. He started with the company in 1928 in the Treasury Department in Akron. In 1934 he was appointed treasurer and director of the Canadian company. He was made vice-president in 1945 and executive vice-president in 1950.

► The Export Division of Hodag Chemical Corp., Chicago, Ill., has announced the selection of Canerpa, Ltd., Montreal, to represent Hodag in Canada. Alex Cherney of Canerpa in Montreal, and G. Stoner of the Canerpa branch in Toronto, will provide customer services, and handle routine and special technical problems in foam control, and other applications for surfactants. Both of these men are widely experienced in chemical sales and engineering, and have especially qualified as consultants on the use of Hodag antifoam agents. Canerpa, Ltd., is a diversified sales operation, with offices and associates around the world. They have had extensive experience as sales representatives for chemical products. Canerpa's main office is in Suite 223, 1117 St. Catherine Street West, Montreal, with a branch office at 137 Wellington St. West, Toronto.

► The appointment of J. A. Blondon to the position of division purchasing agent for rubber for the Dominion Rubber Co., Ltd., Montreal, was recently announced by W. J. Peterson, director of purchases for the company. Mr. Blondon succeeds L. T. Jones who has been made purchasing agent for textile fabrics, yarns and leather, for the company.

► The Eighth Canadian High Polymer Forum will be held at MacDonald College, Que., Canada, May 12-14, 1958. This meeting is co-sponsored at eighteen-month intervals by the National Research Council of Canada and the Chemical Institute of Canada and solicits papers on all aspects of Polymer Science.

Authors of papers are requested to contact the program chairman, Dr. M. H. Jones, Department of Chemistry, Ontario Research Foundation, 43 Queen's Park, Toronto 5, Ont., giving title and authors. Abstracts of approximately 300 words will be required before April 30, 1958, for inclusion in the program. The annual forum banquet to be held on May 12th, will be addressed by Professor G. Gee of the University of Manchester, England.

Single or double rooms for male registrants will be available at $3.00 per person in the College dormitories and reservations should be directed to Dr. E. B. Bagley, Central Research Laboratory, Canadian Industries Ltd., McMasterville, Que. Married couples and other registrants desiring accommodation off the campus may obtain rooms in conveniently located motels either by direct arrangement or through Dr. Bagley. Travel information and any other assistance may be obtained from the chairman of the Eighth Canadian High Polymer Forum, Dr. D. G. Ivey, Department of Physics, University of Toronto, Toronto, Ont.

► The highest award in Canadian business purchasing has been made to Alan L. Francis, assistant general purchasing agent of the Goodyear Tire & Rubber Co. of Canada, Ltd., New Toronto. Mr. Francis was named a Fellow of the Canadian Association of Purchasing Agents at its annual convention in Toronto. The award was in recognition of "his major contribution towards establishing an autonomous Canadian purchasing association while retaining the group's affiliation with the U. S. body, the National Association of Purchasing Agents." A former vice-president of the U. S. organization, Mr. Francis became the Canadian association's first president in 1955.

► Construction of a new plant for the production of metallic stearates was announced by the Witco Chemical Co., Canada, Ltd. The new plant, located southwest of Toronto, is expected to be completed early in 1958, and marks the first step in Witco Canada's plans for manufacturing facilities.

Witco Canada is negotiating for a license from the Witco Chemical Co. in the U.S., entitling them to use the Witco name and production know-how. Witco stearates are known throughout the U.S. for their high quality, plus the fact that different types and grades are produced to meet customer needs. Witco Canada intends to provide this same type of service.

► Du Pont Co. of Canada (1956) Ltd., Montreal, Que., has announced plans to erect a plant for the production of linear polyethylenes, a type of plastic which is new to Canada. The plans involve a site in Moore Township, just south of Sarnia, Ont., and a plant with facilities for the polymerization of ethylene and compounding of the finished product. Du Pont of Canada's research center at Kingston, Ont., has devoted a major part of its effort over the past two years to the development of the product and process to make manufacture in Canada possible. In the United States, E. I. du Pont de Nemours and Co., has had a semi-works unit in operation for more than a year. Linear polyethylenes are a new family of resins possessing a combination of physical properties which result in the manufacture of products said to be more impermeable, have improved chemical resistance, higher softening temperatures and better abrasion resistance. They are also stiffer, stronger and harder, the company says. Possessing excellent processing properties, the new polyethylenes are expected to make possible the production of improved molded products.

► Canadian tire manufacturers expect to hold the line on tire prices, although a 3 per cent to 5 per cent price increase has already been announced in the U. S. R. C. Berkinshaw, president of Goodyear Tire & Rubber Co. of Canada, Ltd., says the situation in Canada is not the same as in the U.S. and there is "no question" of an increase. Other industry spokesmen stated that they had not heard of any plans of the kind. The Canadian company's wage contract does not come up for renewal until next year, Mr. Berkinshaw reported.

Dunlop Offers Two New Tires

► Dunlop Tire and Rubber Corp., Buffalo, N. Y., has announced the addition of two new tires to its line, the "Super Gold Cup Logger Excavator Tire" and the "Deluxe Passenger Car Tire". Designed specifically to meet the rugged requirements of strip mining and logging operations, the Super Gold Cup Logger Excavator is produced in nylon only and is of full ply construction. The tire has exclusive Dunlop tension-free construction strengthened with four nylon breaker strips. The tread pattern features three deep continuous rolling ribs, notched at intervals to facilitate traction on uneven ground and to "throw off" traction-impending objects, the company says. The shoulder area features a heavy lug pattern for traction on sand and soft ground. Designed primarily for off-road service under heavy loads, the tire provides lateral and circumferential traction for up-and-down hill work and in loose ground. The tire is also suitable for short hauls on paved roads, the company claims. The Deluxe Passenger Car Tire is designed to offer Dunlop quality at the lowest possible initial cost. It is available in three sizes, 6.70-15, 7.10-15 and 6.00-16, in black sidewall, tubed, rayon construction.

A. L. Schultz

Promoted by Goodrich Chemical

► A. L. Schultz has been appointed manager of rubber and rubber chemicals development at the Avon Lake Development Center for B. F. Goodrich Chemical Co. He succeeds Edwin W. Harrington, who has been named plant manager of the company's Akron chemicals plant. Mr. Schultz is a graduate of Drexel Institute of Technology, where he received a Bachelor of Science degree in chemical engineering in 1939. He joined Goodrich in 1942 as a shift foreman in a synthetic rubber plant and from 1944 to 1947, he was a process engineer, designing various chemical process pilot plants. In 1947, Mr. Schultz became a development supervisor. Most recently, he organized the first group of technical economists within the company to evaluate chemical processes and later supervised chemical process development on several projects. He has also headed an investigative group for the development of completely new products. Mr. Schultz is a member of the American Institute of Chemical Engineers, American Chemical Society, Tau Beta Pi honorary Engineering Fraternity and the American Association for the Advancement of Science.

Thiokol Introduces LP-205

► A new polysulfide liquid polymer, "LP-205", said to have improved low temperature properties with a service range of from minus 95°F. to 250°F., has been developed by Thiokol Chemical Corp., Trenton, N. J. Typical properties of the new material are clear, amber coloring; a specific gravity of 1.130 @ 20/25°C; viscosity of 1200-1700 @ 25°C centipoise; moisture content of 0.1% max.; pH (water extract) of 6.0-8.0; an average molecular weight of 1200 and stability for more than two years. The liquid polymer is converted to the rubber state through reaction with the mercaptan terminals. Properties of the converted polymer depend upon formulation and method of compounding.

Two New Reports Issued By OTS

► Recent developments in an Air Force search for new elastomers with outstanding properties for special high temperature uses have been described in two reports by the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. The first report PB 131178 describes progress in the development of a rubber for special applications with such properties as thermal stability above 350°F; resistance to aromatic fuels, synthetic ester-base oils, hydraulic fluids, ozone, weather oxidation, acid, bases, salts and abrasion, and satisfactory performance at minus 65°F. or lower. Preparation, compounding, crosslinking, and properties of hexafluoropentylene adipate elastomer are described. Entitled *Investigation of Condensation Type Elastomers* by G. C. Schweiker and others, Hooker Electrochemical Co. for Wright Air Development Center, U. S. Air Force, the 55 page volume was published in May, 1957 and is priced at $1.50.

The second report, PB 131205, is entitled *Preparation and Polymerization of Some Fluoroalkylmethylcyclosiloxanes,* by E. C. Stump, Jr., Wright Air Development Center, U. S. Air Force. Silicone rubbers have shown promise of withstanding the wide range of temperatures to which elastomeric component parts of new aircraft will be exposed, according to the report. However, silicones lack resistance to fuel, oil and hydraulic fluid systems in which they must operate. This study was part of a project to prepare silicone rubbers containing fluorine with the anticipation of increasing fuel and oil resistance. The volume was published in May, 1957, consists of 17 pages and is priced at 50 cents.

Polyethylene Study Released

► An Army Ordnance study, entitled *Effects of Rubber Compositions, Rubber Chemicals, and Plasticizers Upon Polyethylene,* by S. Axelrod, Picatinny Arsenal, recently released through the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., reports that the tensile strength and elongation of polyethylene are not generally affected seriously by contact with rubber compositions. In this study, Report No. 131091, the effects of contact with rubber formulations, rubber chemicals and plasticizers upon the physical properties of polyethylene were investigated to determine the serviceability of the plastic when used in contact with those materials. The report concludes that compounds formulated without ingredients known to affect the material by themselves, can be expected to have no adverse effects. However, polyethylene will be affected adversely by rubber formulations in which hydro-carbon or ester plasticizers "bleed" to the surface.

The report shows that at 77°C either a coal-tar distillate or stearic acid causes polyethylene to disintegrate. The plastic in contact with different ester plasticizers loses from 1 per cent to 27 per cent of its strength. Published in February, 1957, the report contains 19 pages and is priced at 50c.

Dan T. Bradley

Appointed Clevite Vice-President

► Clevite Harris Products, Inc., Cleveland, Ohio, has announced that Dan T. Bradley has been named vice-president and technical advisor and Frank S. Treco., Jr., has been appointed general sales manager. A native of Grand Rapids, Ohio, Mr. Bradley was educated in Cleveland and at Oberlin College. He had wide industrial selling and engineering experience before joining Clevite Harris in 1937 as chief engineer. Mr. Bradley belongs to the Society of Automotive Engineers, the American Society for Testing Materials and the American Society for Metals. Mr. Treco, a graduate of Yale University, joined the company in 1953 as a sales engineer in Detroit and was made sales manager in 1956. He is a member of the Society of Automotive engineers.

Emery Vinyl Plasticizer

► A new, relatively low cost, low temperature plasticizer for vinyls, "Plastolein 9078 LT Plasticizer", has been developed by the Organic Chemical Sales Department of Emery Industries, Inc., Cincinnati, Ohio. According to the company, the new product was designed to meet the need for a low temperature plasticizer in the adipate price range. Compared to adipates, the new plasticizer is said to offer better low temperature flexibility as measured by both the Masland Impact and Clash-Berg tests. Plastolein 9078 possesses higher efficiency and substantially greater compatibility than adipate and imparts higher tensile strengths at efficiency concentration, lower oil extraction and appreciably lower volatility, the company states.

New Officers Appointed

► Kelly-Springfield Tire Co., Cumberland, Md., has announced the appointment of new officers. George B. Newman has been named executive vice-president; Arthur A. Verner, vice-president of export sales, and James C. Warden has been appointed vice-president of manufacturing.

Financial News

General Tire

► Nine months ended August 31: Estimated net income of $8,545,592, which is equal to $1.61 per share of common stock, compared with estimated earnings of $6,059,025 in the nine months ended August 31, 1956. Figures for 1956 do not include earnings of RKO Teleradio Pictures, Inc., the company's wholly-owned radio, television and entertainment subsidiary. Sales at the nine month mark of 1957 totaled $311,091,049, compared with $278,192,007 in the corresponding period last year.

Dayton Rubber

► Nine months to July 31: Net income of $1,304,215, which is equal to $1.32 a common share, compared with $1,630,179, or $1.90 a share, in the corresponding nine month period of the preceding year. Sales in the first nine months of 1957 totaled $59,872,283 compared with $54,172,336 during the same period of 1956.

Acushnet Process

► Six months to June 30: Net income of $580,853, which is equal to $2.39 a share, compared with $513,240, or $2.11 a share, in the first half of the preceding year. Sales in the six months to June 30 totaled $7,768,087, compared with $6,825,959 in the same period last year.

Triangle Conduit & Cable

► Six months to June 30: Net income of $1,759,000, which is equal to $1.29 a common share, compared with $1,712,000, or $1.26 a share, in the first six months of 1956. Sales in the first half of this year totaled $28,188,000, compared with $28,304,000 in the corresponding period last year.

Okonite

► Nine months to September 30: Net loss of $96,820, compared with a net income of $1,208,209, which is equal to $6.24 a share, in the 1956 nine-month period. A company spokesman said the deficit in the 1957 period reflected heavy expenses in transfer of production facilities, reduced copper prices, a five-week strike, greater competition and increased labor costs.

St. Joseph Lead

► Nine months to September 30: Net income of $7,169,620, which is equal to $2.64 a common share, compared with $7,371,129, or $2.71 a share, at the end of the third quarter of 1956. Sales in the first nine months of the year totaled $83,207,204, compared with $87,594,288 in the same period last year.

Goodall Rubber

► Nine months to September 30: Net income of $490,525, which is equal to $1.02 a common share, compared with $480,758, or $1.02 a share, in the corresponding nine months of the preceding year. Sales in the first nine months of the year totaled $9,302,097, compared with $8,971,208 in the first nine months of 1956.

Seiberling Rubber

► Nine months ended September 30: Net income of $884,043, which is equal to $1.72 per common share, compared with $813,919, or $1.55 a share, in the first nine months last year. Sales in the 1957 nine month period totaled $35,562,174, compared with $35,613,494 at the end of the third quarter of 1956.

B. F. Goodrich

► Nine months ended September 30: Net income of $30,254,077, which is equal to $3.38 a share of common stock, compared with $30,667,340, or $3.44 a share, in the first nine months of 1956. Sales in the first nine months of this year totaled $560,802,565, compared with $538,646,156 in the 1956 period.

Hewitt-Robins

► Nine months ended September 30: Net income of $862,816, which is equal to $2.09 per common share, compared with $785,346, or $1.88 a share, in the equivalent period of the preceding year. Net sales in the 1957 nine month period totaled $41,405,500, compared with $38,907,286 in the first nine months of 1956.

U. S. Rubber

► Nine months to September 30: Net income of $22,982,452, which is equal to $3.40 a share of common stock, compared with $23,453,685, or $3.54 a share, in the same period last year. Sales in the first nine months of 1957 totaled $665,360,840, compared with $675,147,998 at the same time last year.

Sheller Mfg.

► Nine months to September 30: Net income of $1,511,993, which is equal to $1.59 per share, compared with $826,467, or 87c a share, in the nine month period of 1956. Sales at the third quarter of 1957 totaled $31,510,379.

Electric Hose & Rubber

► Year ended August 31: Net income of $1,389,360, which is equal to $3.86 per share, compared with $1,139,754, or $3.17 a share, in the preceding fiscal year.

Goodyear Sets Up New Department

► A New Products Department has been established by the Goodyear Tire and Rubber Co., Akron, Ohio, to stimulate new product ideas as well as to speed up and support decisions for the initiation and progress of new product projects. The new unit will augment and facilitate the work of the company's Research, Development, Production and Sales Departments in their responsibilities for new products, ideas and investigations. The Department will have organizational responsibility to Sam DuPree, vice-president of the general products group, and will have reporting responsibility to the policy committee. M. J. DeFrance, former manager of chemical materials and products development, has been named director of the newly created department. Appointed administrators were H. J. Bliss, C. B. Marks and C. T. Wittl.

Mr. DeFrance joined the company in 1929 as a research compounder. After several promotions, he was named manager of chemical materials and products development, a post he held until his recent assignment. Mr. Bliss also joined Goodyear in 1929. Most recently, he served the company as works accountant at the Los Angeles plant. A member of the firm since 1937, Mr. Marks joined Goodyear shortly after his graduation from Columbia University, serving as sole and heel advertising representative with the Shoe Products Division. He had been manager of manufacturers sales for shoe products since 1954. Mr. Wittl joined Goodyear in 1948 as a member of the production squadron. In 1953, he became development engineer for special products.

New Polyethylene Unit Planned

► Union Carbide Corp., New York, N. Y., has announced that production facilities for Bakelite polyethylene resins will be increased with the completion of a newly authorized plant at Whiting, Ind., during the first half of 1959. A high pressure polyethylene plant with a rated annual capacity of 72,000,000 pounds, the new structure will raise Union Carbide's total rated annual production capacity to more than 375,000,000 pounds. The unit will be built and operated by Union Carbide Chemicals Co., with sales and technical services supplied by Bakelite Co., both divisions of Union Carbide. The plant will expand services of the Bakelite Co. to polyethylene fabricators in the Midwest and Central States areas. This will be the ninth Union Carbide plant involved in the production and compounding of Bakelite polyethylene resins.

Acquires Moxness Shares

► National Rivet & Manufacturing Co., Waupun, Wisc., has acquired a substantial interest in Moxness Products, Inc., Racine, Wisc., according to an announcement by Sven K. Moxness, president of Moxness. Mr. Moxness said no changes are planned in the management of the company and that its operations will continue in Racine, where the firm is also building a new plant.

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R. S. Walker

Joins Goodyear Chemical

► Chemical Division of the Goodyear Tire & Rubber Co., Akron, Ohio, has announced the appointment of R. S. Walker as sales engineer for Chemigum rubber. Mr. Walker has had more than six years' experience in the rubber industry, having served as assistant technical director supervising an elastomer testing laboratory and later as chief rubber chemist. He was graduated from Lehigh University with a bachelor of science degree in chemical engineering and is an active member of the Rubber Division of the American Chemical Society and the American soci- of Testing Materials.

Petrochemical Unit Completed

► A new petrochemical plant at Louisville, Ky., constructed by the Stauffer Chemical Co., New York, N. Y., is now on stream, producing chloroform, methylene chloride and additional quantities of carbon tetrachloride and hydrogen chloride. Construction of the Louisville project began in 1952 and the first unit completed in early 1954 for the manufacture of perchloroethylene, carbon tetrachloride and anhydrous hydrogen chloride. The unit just completed utilizes another hydrocarbon gas feedstock, providing the company with additional product lines and permitting a greater flexibility of manufacturing operations. With the new installation, the basic raw materials may be varied to make whichever chemical is in greatest demand. In addition to the chemical plant, the company has also installed extensive dock facilities and can be supplied with chlorine from producers located on the Ohio or Mississippi rivers or their tributaries.

Hall Forms New Department

► C. P. Hall Co., Akron, Ohio, has announced the formation of a Machinery Department to handle the sale of mills, presses, loaders, lift tables, preform machines and roving cutters throughout the state of Ohio for the Erie Engine and Manufacturing Co. C. P. Hall Co. of California has represented EEMC on the West Coast for the past three years.

Goodyear Personnel Changes

► Industrial Products Division of the Goodyear Tire & Rubber Co., Akron, Ohio, has announced a major reorganization of research and development personnel "to improve liaison between Akron operations and outside industrial products plants". H. E. Morse, formerly manager of industrial shoe products development, has been appointed director of industrial products development. D. E. Harpfer has been promoted from assistant manager of industrial products development to manager of industrial products technical liaison. John H. Gerstenmaier, who had been manager of development at the St. Marys, Ohio plant, has been promoted to manager of industrial products development. J. J. Hickey, formerly head of development at Wolverhampton, England, has been named manager of industrial products development for international plants. The following will report to Mr. Gerstenmaier: P. D. Suloff, manager of industrial products design; G. K. Higgins, manager of industrial products compounds and E. G. Kimmich, chief engineer for industrial products. J. L. Hawley, manager of special products and fuel cell developments, continues to report to Mr. Morse.

U. S. Rubber Promotes Martin

► Edwin A. Martin has been appointed assistant general manager of the Footwear and General Products Division of the U. S. Rubber Co., New York, N. Y., succeeding C. William Pennington who was recently elected a vice-president of the company and general manager of the Footwear and General Products Division. Mr. Martin was formerly plant manager of the Chicago, Ill. plant where Royalite thermoplastic material is made. A graduate of Rose Polytechnic Institute in Terre Haute, Ind., he started with the company in January, 1947 as an industrial engineer in the Mishawaka, Ind. plant. In March, 1951, he was made assistant superintendent of the Mill Department. He was transferred to the Chicago plant as manager of industrial engineering in 1953 and in October, 1954, he was appointed factory manager of the plant.

Goodrich Promotes Spaulding

► G. Allen Spaulding, former production superintendent of the B. F. Goodrich tire plant in Oaks, Penna., has been named manager of the Miami, Okla., tire plant succeeding Walter E. Head, newly appointed manager of manufacturing for the B. F. Goodrich Tire Co. Mr. Spaulding was graduated from Ohio University in 1940 with a B. S. in science and immediately afterwards joined Goodrich in Akron as a time study engineer. During World War II, he served in the U. S. Navy as a lieutenant, returning to the company as an industrial engineer in 1946. He was transferred to the Tuscaloosa, Ala., tire plant as manager of time study and methods in 1948 and in 1951, he was appointed production superintendent of the Miami plant. He was transferred to the Oaks plant as production superintendent in 1955.

Thomas Zawadzki

Elected Vice-President

► Thomas Zawadzki has been elected vice-president in charge of sales and a member of the board of directors of Cary Chemicals, Inc., Milltown, N. J. Mr. Zawadzki graduated from Princeton University in 1947 with a B. S. degree in Chemistry and in 1950 he received his M. S. E. degree in plastics engineering at the same University. He was a plastics chemist at the General Cable Corp. from 1951 to 1954 and a senior sales representative in the New York City area for the Firestone Plastics Co. from 1954 to 1956. Mr. Zawadzki joined Cary in 1956.

Produces New Type Plastic

► Hercules Powder Co. has begun commercial production of a new type of polyethylene plastic material at a new plant in Parlin, N. J. The plant, which has a production capacity of 30 million pounds a year, is the first in this country to utilize the Ziegler catalyst process, developed in Germany by Dr. Karl Zeigler of the Max Planck Institute for Coal Research at Muhlheim, West Germany. The company claims that the new polyethylene is harder, stiffer, and more resistant to abrasion and higher temperatures than conventional polyethylene. Products made from this material may be sterilized. To be sold under the brand name of "Hi-fax," the new material also has more tensile strength and is less permeable to gases and more resistant to environmental stress cracking, Hercules officials claim. Hercules obtained this market-development material through a two-way exchange agreement with Farbwerke Hoechst, A. G., of West Germany, said to be the first company to translate the Ziegler process from laboratory to commercial production.

Sargent Purchases Property

► C. G. Sargent's Sons Corp., Graniteville, Mass., has purchased property in Graniteville which was formerly known as the Abbot Worsted Mills. The purchase includes mill buildings of 56,000 square feet and a separate adjacent office building. Sargent will occupy a substantial part of the buildings immediately for expansion of its Fabrication Department.

West Coast News

► Several personnel changes have been announced at the Los Angeles plant of the B. F. Goodrich Tire Co., including the appointment of James M. Robbins as manager. Associated with the company since 1928, he has served various manufacturing divisions of the company both in the U. S. and abroad. Frank E. Harper, formerly plant manager, has been appointed director of employee relations for the company. He has been associated with the Goodrich organization since 1942. Paul D. Finley has been named production superintendent at the plant. He joined Goodrich in 1933 and has held supervisory posts since 1942. Thomas W. Blazey, formerly office manager at the Los Angeles plant, has been named chief accountant for the B. F. Goodrich Tire Co. with headquarters in Akron, Ohio. He has been with the Goodrich organization since 1946.

► Extruded Products Division of Stillman Rubber Co. has moved into a new 10,000 square foot building alongside present facilities. This completes a two-phase expansion program that has increased production capacity by 100 per cent. The new building brings total covered factory area to 20,000 square feet. Earlier in the year, the company moved to a 7,000 square foot building in the first phase of the expansion program. The division's activities are currently consolidated at three adjacent buildings.

► Plastic and Rubber Products Co. has opened a new addition to the company's Los Angeles plant, which is said to represent an increase of more than 50 per cent to the existing space. The new building will house the Sales Department, Order Department, Personnel, Credit Union, Factory Offices, Laboratory, Engineering Offices, a complete Silicone and Special Materials Production Department and a modern die shop.

► California Rubber Products Co., formerly located at 130 N. Hawthorne Blvd., Hawthorne, Calif., has announced the removal of its general offices to 1754 S. Crenshaw Blvd., Torrance, Calif. The new property consists of 46,000 square feet with a 25,000 square foot building and the company has an option on an additional 40,000 square feet for expansion.

► Bettis Rubber Co., Whittier, Calif., has purchased the Houston, Texas, plant of the Plastic and Rubber Products Co. The facility will be known as the Houston Rubber Co. Laird Pierce, a part owner of the new company, is moving to Houston.

► H. M. Royal, Inc., has moved into a new office and warehouse in Downey, Calif. The address is 11911 Woodruff Ave. and the new phone number is Topaz 1-0371.

► Norm Stingley, formerly associated with Fullerton Manufacturing Co., is now with the Bettis Rubber Co., while Tony Lipsky has joined the Fullerton staff as a chemist.

► George A. Watt is now chief chemist at the Rubber Corp. of California in Garden Grove, Calif.

► Frank Krause has retired after 40 years service with the U. S. Rubber Co.

Atomic Rubber Thickness Gauge

► Delco-Remy Division of General Motors Corp. has announced that the company is using beta rays from a radioisotope gauge to assure uniform thickness in rubber separators used in its batteries. Resembling an elongated "C" clamp, the gauge emits a constant stream of beta rays from a radioactive source. A detector gauge in the upper jaw of the clamp receives and records these rays. As a rapidly moving sheet of soft rubber passes between the jaws, the detector counts the number of rays that penetrate the rubber and translates this information into thickness measurements for charting. Thick spots in the material allow fewer rays to reach the detector while the thinner portions admit correspondingly greater numbers. This is said to provide a continuous and almost instantaneous quality control for the battery separators. Company officials report the device records thicknesses to one-ten-thousandth of an inch with an error of less than 1 per cent.

Offers New Label For Silicones

► Avery Adhesive Label Corp., Monrovia, Calif., has introduced an oil and heat resistant label for use in product identification, which is said to adhere firmly to silicone rubber. The pressure-sensitive labels are applied before the rubber is molded to provide permanent gripping identification and are available in a variety of shapes and sizes. Expected to improve color coding, the labels are said to resist weather and temperature extremes and should be useful in the identification of such products as automobile transmission seals, aircraft seals and ducts, roll coverings used in food processing, electrical cables, and tires being developed for high-speed aircraft. The new product may be applied with manual or automatic dispensers and bond smoothly creating the appearance of being part of the rubber. Although the labels will crack if the silicone rubber is elasticized sharply, they grip firmly under the roughest handling methods, the company says.

To Build Polyethylene Plant

► National Petro-Chemicals Corp. has announced that the company's second polyethylene plant will be constructed in Houston, Texas, on a 200 acre site on the Houston Ship Channel. High-purity ethylene will be supplied to National Petro-Chemicals by Phillips Petroleum Co., under a long-term contract, from Phillips' new ethylene plant at Sweeny, Texas. Phillips will also supply the natural gas requirements for the plant. The new polyethylene plant is scheduled for operation in late 1958. M. W. Kellogg will handle the engineering and construction of the unit. Intermediate-density polyethylene resins will be produced at a rate of 75 million pounds annually by a modification of the conventional high-pressure process, which is already in operation at the company's Tuscola, Ill., plant. The resins will have properties somewhere between those of the original "squeeze bottle" polyethylenes and the new high-density resins produced by the so-called "low-pressure" processes, and the product will be sold under the trade mark "Petrothene" by U. S. Industrial Chemicals Co., a division of National Distillers and Chemical Corp. The company is now producing polyethylene at the rate of 100 million pounds per year at the Tuscola, Ill., plant. The new plant will bring the company's total capacity to 175 million pounds per year.

Foresees Tire Sales Increase

► A gain of six per cent in sales of passenger car tires in the replacement, or retail market has been predicted for next year by E. F. Tomlinson, president of B. F. Goodrich Tire Co. Mr. Tomlinson's prediction was made in a talk at the National Tire Dealers and Retreaders Association Convention. He based his forecast of continuing increases in the replacement business primarily on the increasing use of automobiles in this country and the growing trend of two-car families. Current reports say that an increase of 6 per cent would put 1958 replacement passenger tire volume at around 59 million casings or more. Industry sources have forecast 1957 replacement sales at around 56 million units, a new high, and about 5 per cent above 1956 shipments of about 53.3 million tires.

Eberhard Faber Moves

► Eberhard Faber Pencil Co. has announced that the firm has moved from its Brooklyn facilities to a new factory at Crestwood, Wilkes-Barre, Penna. The move, the company says, will permit production of improved specialized writing instruments for the rubber industry, especially for marking hot rubber during production, and will enable Eberhard Faber to supply these writing instruments in greater quantity, variety and quality. The new multi-million dollar plant is a one-level unit which occupies seven acres of a 38 acre site. It is equipped with extensive product design and research laboratories.

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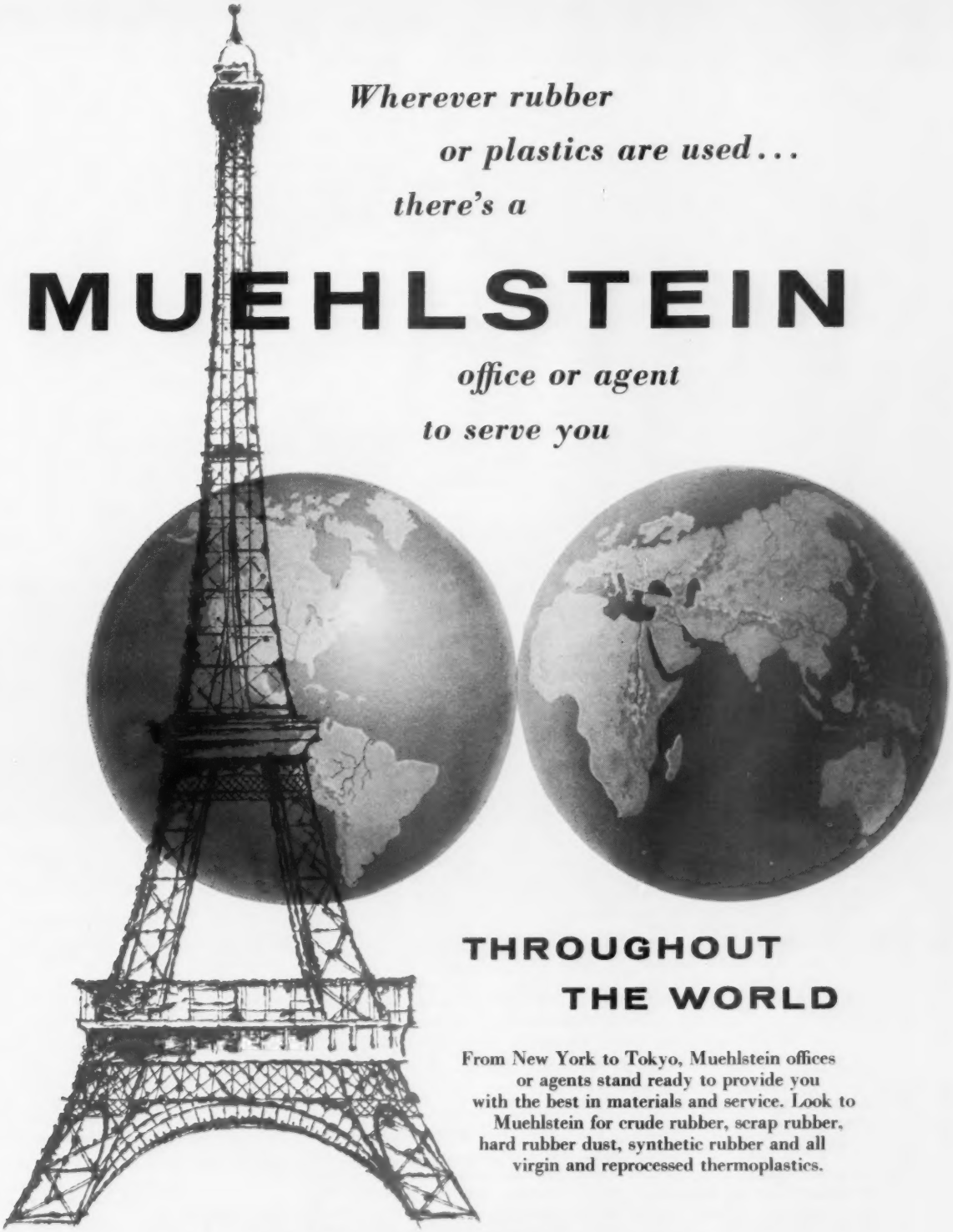

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Obituaries

Furber I. Marshall

► Furber I. Marshall, president of the Carlisle Corp., Carlisle, Penna., died on September 29 at Carlisle Hospital. He was 62 years old. Born in Rochester, N. H., Mr. Marshall attended the University of Pennsylvania and Brown University, graduating from the latter in 1919. He began his career as sales manager of the Western Petroleum Corp. From 1928

to 1929, he was president of the Bendix Sales Corp. and from 1930 to 1943, he was general manager of the Marshall Eclipse Division of the Bendix Aviation Corp. He became president of the Pharis Rubber Co. in 1943 serving until 1948, when he was named president of Carlisle. In addition to this post, he also held office as chairman of the board of the Dart Truck Co., Kansas City, Mo., and was a member of the board of the Stoner Rubber Co., Anaheim, Calif. During World War I, he served as an instructor in the Air Service. Mr. Marshall was a member of the Society of Auto Engineers and several civic and social organizations. He is survived by his wife.

Zina A. Wise

► Zina A. Wise, Sr., president of Griffith Rubber Mills, Portland, Ore., died on September 19 during a business trip to San Francisco, Calif. He was 57 years old. Mr. Wise became manager of Griffith Rubber Mills in 1933 and in 1951, he became its president. Under his leadership, the company acquired a wholly owned subsidiary in Seattle, Wash. and affiliation with a Vancouver, B. C., mill. He was also associated with the Warren Construction Co.; States Steamship Co.; Crown Willamette Paper Co.; Investors Co. of Oregon; Oregon Insurance Finance Co. and was president of Wise Products, Inc. Mr. Wise was a member of many civic and social organizations. He is survived by his wife and two sons.

Roy H. Kienle

► Dr. Roy Herman Kienle, director of the Research Service Department, Stamford Laboratories of the American Cyanamid Co., died on September 2 in Stamford Hospital, Stamford, Conn. He was 61 years old. Dr. Kienle was formerly director of applied research at the company's plant at Bound Brook, N. J., where he dealt in pigments, dyes, textile finishes and resins. From 1919 to 1933, he was research chemist at the General Electric Co. at Schenectady, N. Y., working with resins, polymers, coatings and electrical insulations and plastics. A native of Easthampton, Mass., Dr. Kienle was valedictorian at Williston Academy in the class of 1912. He received a B. S. degree from Worcester Polytechnic Institute in 1916, a Master's degree from Union College in 1927 and a Ph. D. in chemistery at Rutgers University in 1938. Dr. Kienle was once Adjunct Professor at Polytechnic Institute of Brooklyn and was the author and co-author of many technical articles on coatings and related materials. During World War I, he served as a first lieutenant in the Chemical Warfare Service. He was a member of the advisory committee of the Office of Scientific Research and Development during World War II. Dr. Kienle was a member of many industrial, civic and social organizations. He is survived by his wife and two sons.

Harold B. Naramore

► Harold Beers Naramore, chairman of the Bridgeport Fabrics Co., Bridgeport, Conn., died on September 26 at Lebanon, N. H. He was 69 years old. Mr. Naramore was born in Bridgeport, and joined the Bridgeport Coach Lace Co. in 1905 and worked his way up through various departments. He was named secretary of the organization, and in 1927 became president. Mr. Naramore has served also as head of the Canadian affiliate of the textile company, as treasurer of the Donahue Co. of Canada, Ltd. and as a director of Wonder Weave, Inc. of Boston, both allied groups. Mr. Naramore was the holder of a number of patents pertaining to the automotive industry.

Waldemar R. Kuenzel

► Waldemar R. Kuenzel, a vice-president of Deering, Milliken and Co., Inc., New York, N. Y., died on October 4 in Valley Hospital, Ridgewood, N. J., after a brief illness. He was 53 years old. Mr. Kuenzel was associated with E. I. du Pont de Nemours & Co. in New York as a textile technician before he joined Deering, Milliken. He was a member of the American Association for Textile Technology and the Ridgewood Country Club in Ridgewood, N. J. and in New York, the Union League and the Arkwright Clubs. Surviving are his wife, a son and a daughter.

George M. Madole

► George M. Madole, first manager of the B. F. Goodrich Co. French plant on the outskirts of Paris, died on September 27 at his home in Canton, Ohio. He was 65 years old. Mr. Madole retired from the Goodrich organization after more than 30 years of service because of ill health. At the time of his retirement, he was assistant general sales manager in tires. He had returned to Akron from France in 1938. Mr. Madole joined Goodrich in 1910 as a member of the company's Experimental Department. He was in the company's Balloon and Airship Building Departments from 1917 until the close of World War I. In 1919, he went into the Tire Division and a year later, he was sent to the French plant as assistant superintendent. Mr. Madole became works manager in 1923 and later was named assistant managing director. He was a member of the French Legion of Honor, having received the award in 1935 for "distinguished services in French industry." Mr. Madole spent 18 years in France and was active on various Parisian committees and in French business circles. Surviving are his wife and a son.

Byron R. Barder

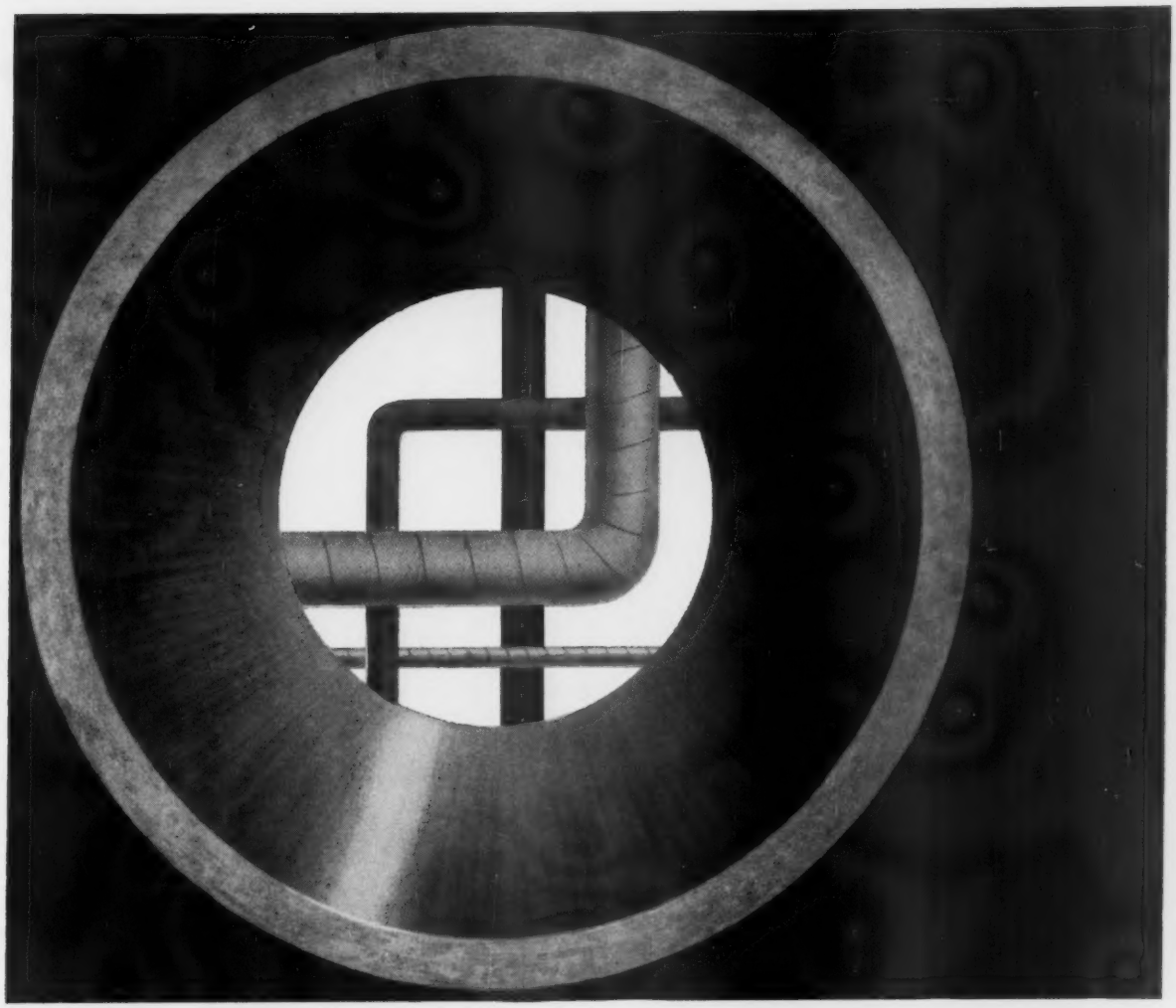
► Byron R. Barder, former president and treasurer of the Biggs Boiler Works, Akron, Ohio, died on Wednesday, September 11 at his home in Akron. He was 79 years old. Mr. Barder was born in Akron and attended the public schools there. At the age of 16, he began to work in the office of the Biggs concern. Later, he became president and treasurer of the firm and served in these capacities until 1948, when he sold the company. Mr. Barder was a city councilman, a vice-president of the Akron Chamber of Commerce and a member of many civic and social organizations. Surviving are two daughters.

Harold G. O'Brien

► Harold G. O'Brien, president of both the Lewiston Rubber Co. and the Eastern Shoe Supply Co., is believed to have drowned in a recent accident in which his small pontoon plane crashed while landing on the Androscoggin River in Maine. With him were his daughter Rita, who is also believed drowned, as well as another passenger. An observer, taxiing along the river said the O'Brien Cessna plane began to land in his path and attempted to pull up at the last minute but the motor stalled.

David P. Brannin

► David P. Brannin, retired western district sales manager for the New Jersey Zinc Co., New York, N. Y., died on September 19 at St. Francis Hospital in Evanston, Ill. He was 69 years old. Mr. Brannin, who lived in Park Ridge, Ill., spent over 32 years in the company's Chicago office. He became district sales manager in 1946 and western district sales manager in 1949, and retired in 1954.



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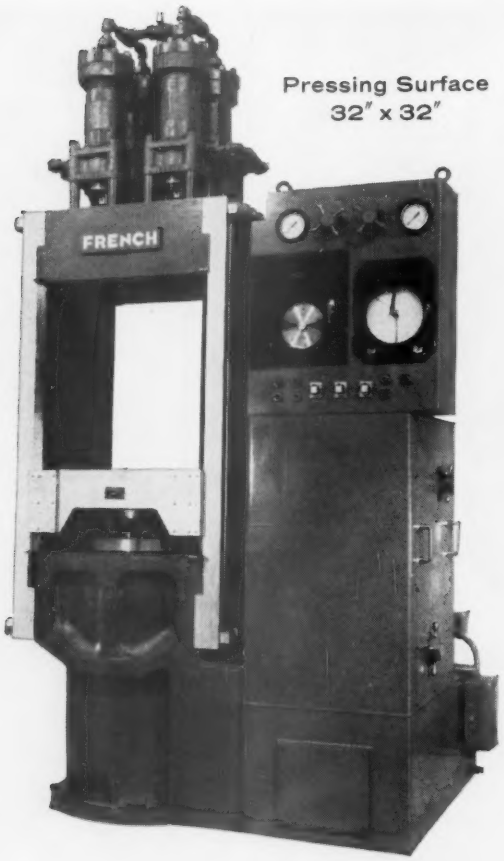

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Overseas

By Comtel-Reuter

Zurich—Swiss raw rubber imports (including scrap) in the first eight months of this year totaled 10,707 tons against 8,180 tons in the same period of 1956. Imports of rubber in the form of ribbons, sheets, strips, balls, etc. (without fabrics or metal parts attached) during the period amounted to 912 tons against 802 last year.

Kuala Lumpur—The price of rubber is expected to increase before the end of this year, according to Warren S. Lockwood, now on a tour in the Far East. Mr. Lockwood said that the future of natural rubber is bright but that steps should be taken to ensure a lead over synthetic.

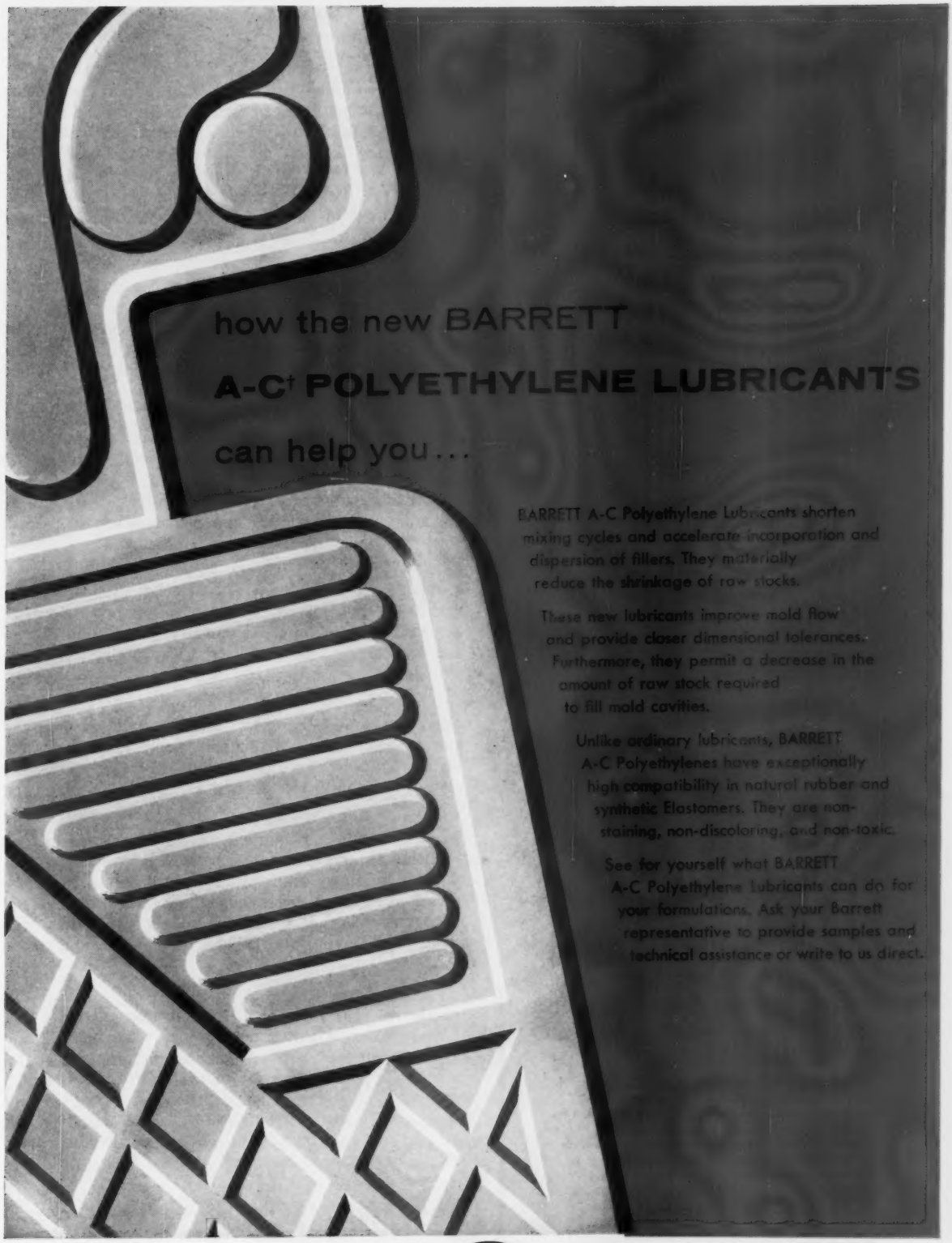
Singapore—The price of rubber hit a new low for the past 16 months, according to traders, who attribute the decline to sentiment rather than necessity. Traders claim that poor sentiment combined with disappointing United States and European demand for lower grades is having a bearish effect on holders.

Djakarta—The quarterly report of the Bank of Indonesia states that Indonesia exported 301,400 tons of rubber valued at 1,800 million rupiahs in the first six months of this year. This was an increase of about 4 per cent in volume but a decrease of about 3 per cent in the value of exports. Of this, estates rubber accounted for 101,900 tons valued at 686 million rupiahs, 9 per cent lower than in the same period of 1956.

Santiago—Tires will be exempted from price controls in Chile under a recent decision taken by the cabinet. The sole producer of tires in Chile said that the lifting of price controls would mean a reduction of about 2 per cent in prices for public transport and agriculture. The Chilean Cabinet has ordered all government departments to buy only domestic tires for their vehicles in the future.

London—A new alternative form of Settlement House Contract No. 7A, known as the London "A" Contract, has been officially quoted on the London rubber market. The new contract calls for two changes in No. 7 Settlement House Contract permitting the seller to deliver ribbed smoked sheets which are inferior to RSS International No. 1.

Singapore—As a result of a dispute over the dismissal of 22 workers at the termination of their contracts with a lighterage contractor, rubber belonging to Goodyear (Orient) Co., Ltd., is lying idle in the firm's warehouse. The Labor Ministry, which is attempting to mediate, states that the matter is under study by a joint consultive committee, representing both employer and employees of the lighterage industry.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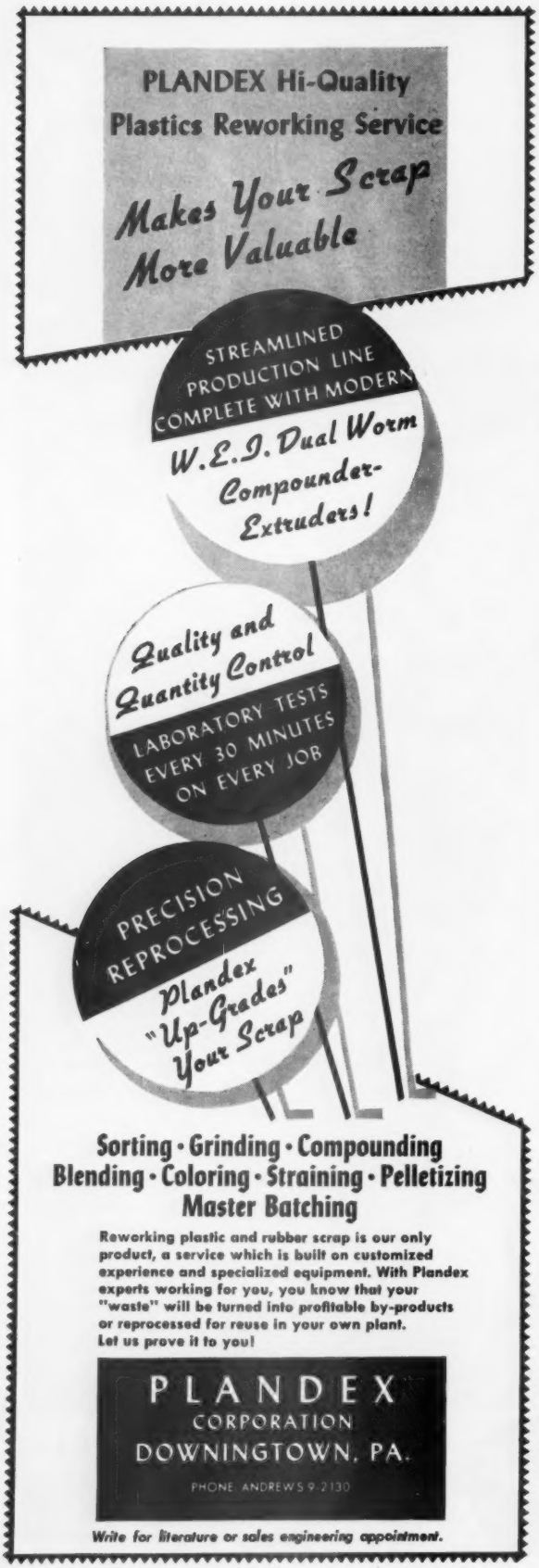


OVERSEAS (CONT'D)

Singapore—Falling rubber and tin prices are helping to widen the gap between Malaya's imports and exports, according to a recent report. It is noted that rubber exports during the first nine months of the year fell by ¾ of 1 per cent and tin shipments were down by 2.7 per cent. A rise in the value of luxury and capital imports was one of the reasons put forward for the current imbalance in trade.

Canberra—An Indonesian trade delegation is planning to visit Australia in the hope of increasing exports of rubber to that country. Indonesian officials state that they hope Australia will be able to supply tires and other products which Indonesia has traditionally obtained from western Europe.

Kuala Lumpur—Federation of Rubber Trade Association in Malaya has decided to ask the government to control the issue of licenses for dealing in rubber. Members state that traders are already finding it hard to maintain their businesses and increases in the issue of licenses would make it still more difficult.

Colombo—The Ceylon government has proposed an increase in the Ceylon rubber cess from 55c per 100 pounds to 82½c, effective January, in order to expand the Rubber Research Institute's Special Plant Breeding Division.

Singapore—A Burmese firm plans to buy six thousand tons of Malayan rubber annually for re-export to Yugoslavia. An officer of the company is presently in Singapore contacting local dealers.

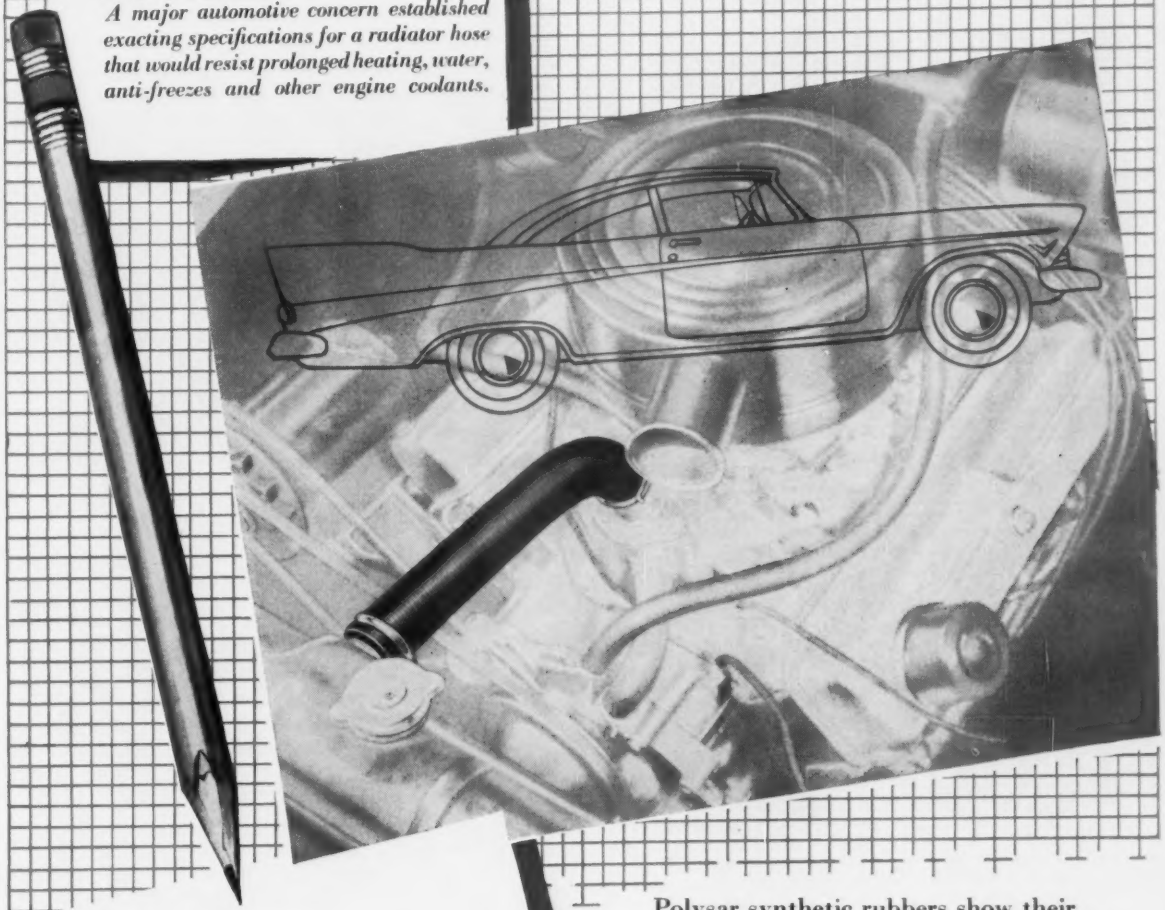
Karachi—Rubber plantations will be developed in East Pakistan on an experimental basis to learn whether rubber can be grown economically in that part of the country. Two Pakistan forest rangers are in Malaya to study rubber growing, and a Dutch rubber expert has been invited to investigate rubber growing conditions in Pakistan.

Canberra—The Australian House of Representatives has introduced tariff amendments which affect natural and synthetic rubber. A spokesman said the proposals represent significant savings for local industry and the duty reduction represents significant concessions to major suppliers of natural rubber. Malaya, which supplies about 90 per cent of total natural rubber to Australia, would be the major beneficiary.

Kuala Lumpur—As a part of a drive to persuade more smallholders to replant rubber, the Malayan Rubber Industry Replanting Board has begun a series of thirteen talks on Radio Malaya's nationwide network. The Penang State Government also announced that replanting schemes, which allow 600 Malayan dollars per acre replanted, are not confined to rubber, but include other products as well.

Problem

A major automotive concern established exacting specifications for a radiator hose that would resist prolonged heating, water, anti-freezes and other engine coolants.



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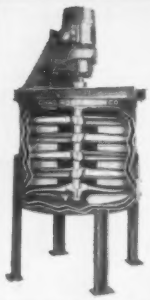
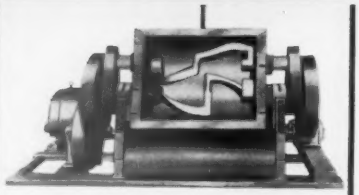
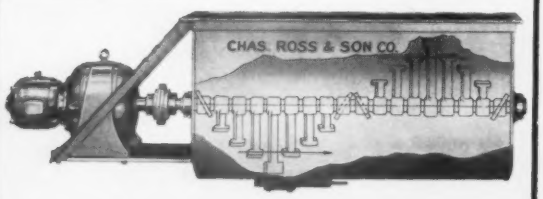


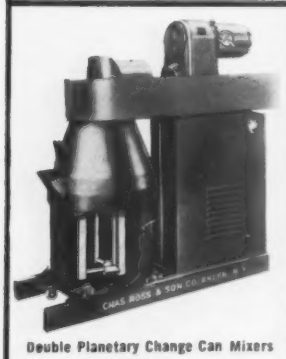
Rubber Cement Mixers
100 - 1000 Gal. sizes



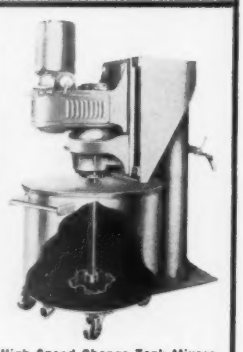
Heavy Duty Double Arm Kneaders
1 pint - 150 Gal. sizes

Rubber Reclaiming Mixers
100 - 1000 Gal. sizes



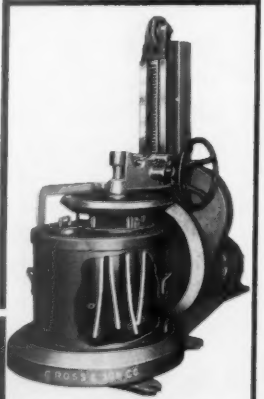


Double Planetary Change Can Mixers
1 - 150 Gal. sizes



High Speed Change Tank-Mixers
80 - 250 Gal. sizes

Heavy Duty Paste Mixers
25-1000 Gal. sizes



Heavy Duty Change Can Mixers
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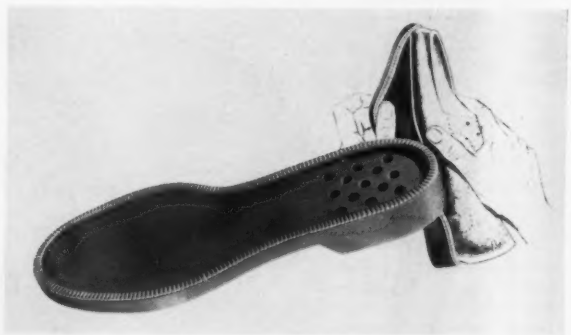
New Goods

Beebe Anchor Sole

► A new sole which is said to introduce an entirely new concept in shoemaking has been introduced by the Beebe Rubber Co., Nashua, N. H. Called the "Beebe Anchor Sole", the lightweight, flexible rubber sole is pre-molded



and features a "lip" that anchors directly to the upper, eliminating many operations in lasting and finishing, the company says. The lip of the Anchor sole extends beyond the edge of the upper and gives the appearance of welting. The sole of the shoe slips over this lip and anchors on, and also pulls off for repair purposes. Shoes thus soled are said to be automatically water-resistant. American patents are pending on the new soling process which was developed in Australia. Beebe has added refinements so that the sole is more adaptable to United States manufacturing methods. According to the company, shoe manufacturers can introduce the new method into their factories almost at once using present machinery.

Resinite Gold Stripe Hose

► Chemical Division of the Borden Co., New York, N. Y., has developed a plastic garden hose which is said to remain flexible in freezing weather and to retain its firmness during the hottest days of summer. Known as the "Resinite Gold Stripe", the hose is constructed of virgin vinyl, reinforced with nylon cord and has an exclusive "Shur-Grip" surface as well as "Shur-Lock" couplings. According to the company, the Resinite Gold Stripe is unique in that the strong braided nylon cord is embedded deeply in the vinyl. As a result, the company says, it resists breakage from twisting and allows for exceptional flexibility at extremely low temperatures and prevents heat-bulging on high temperature days. The hose carries the "Seal of Quality" of the Society of the Plastics Industry, which designates products that meet requirements of "Commercial Standard CS 209-57". The Gold Stripe hose is available in 25, 50, and 75 foot lengths with ½, ⅝ and ¾ inch inside diameters.

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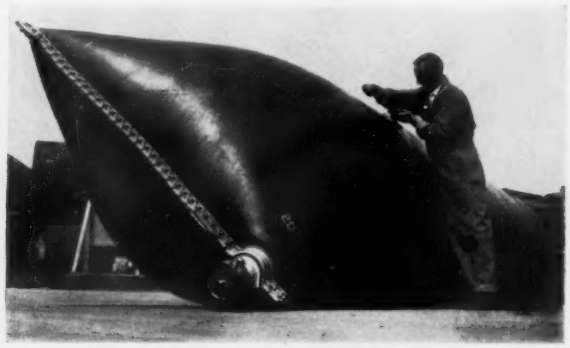
Sealdtank Liquid Transporters

► U. S. Rubber Co., New York, N. Y., has announced the introduction of a giant rubber-fabric container for the transportation of liquid cargo. Called "Sealdtank", the container looks like a giant toothpaste tube when filled. It is 56 inches in diameter, 35 feet long and holds 3,800 gallons of liquid. The tank weighs 1040 pounds



empty and its capacity when filled with molasses, for example, is 22 tons. The Sealdtank is made of four plies of rubber coated rayon tire fabric molded similarly to a tire. Both ends are sealed by metal closures resembling spiral columns. The outer surface is made of neoprene for oil and weather resistance and the inner surface can be made of any of a variety of special rubber compounds which make possible the handling of almost any type liquid. The Sealdtank can be made in any size to fit any truck, railroad car, barge or ship. Placed empty on a trailer truck, it can be filled through a fitting at one end or from the top. Atmospheric pressure collapses the tank as it is emptied at journey's end. Empty, the Sealdtank lies flat and can be rolled into a compact, cylindrical package 25 inches in diameter and 7 feet, 4 inches in length. The flat tube can be rolled up and stored in the forward section of the trailer. When used for storage, the Sealdtank is adaptable to corrosive chemicals.

Redwing Fuel Oil Hose

► An improved version of the "Redwing Fuel Oil Hose" has been developed by the Goodyear Tire & Rubber Co., Akron, Ohio. According to the company, a new tube stock has been compounded that remains flexible in service and which does not permit extraction of the plasticizer from the tube by aromatics in fuel oils. Constructed with two or three braids of rayon, the three-braid hose, said to permit free flow when the hose is reeled up as much as 75 per cent, has been recommended for reel service. The new hose cover and tube are designed for flexible service at temperatures of 40° below zero. Manufactured in sizes from 1 to 1½ inches, maximum working pressures of the hose range from 150 pounds for the two-braid type to 200 pounds for the three-braid type.

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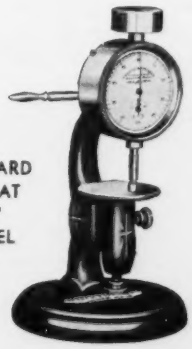

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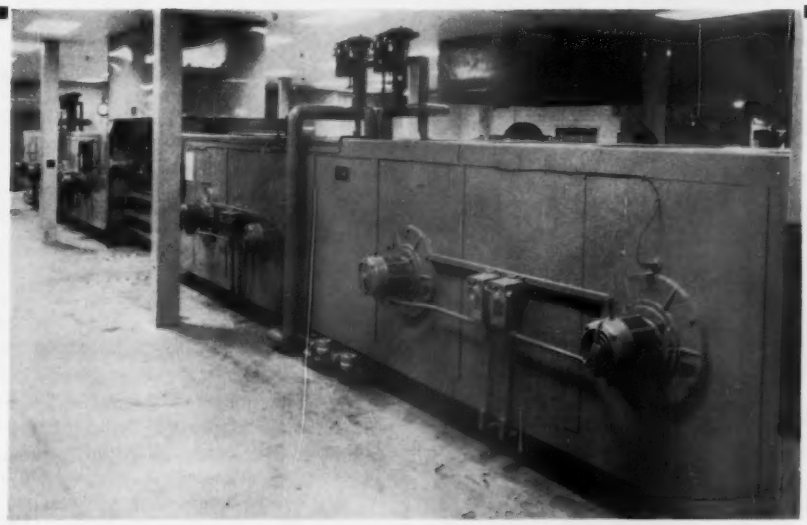
TIRES POLYETHYLENE BUFFINGS



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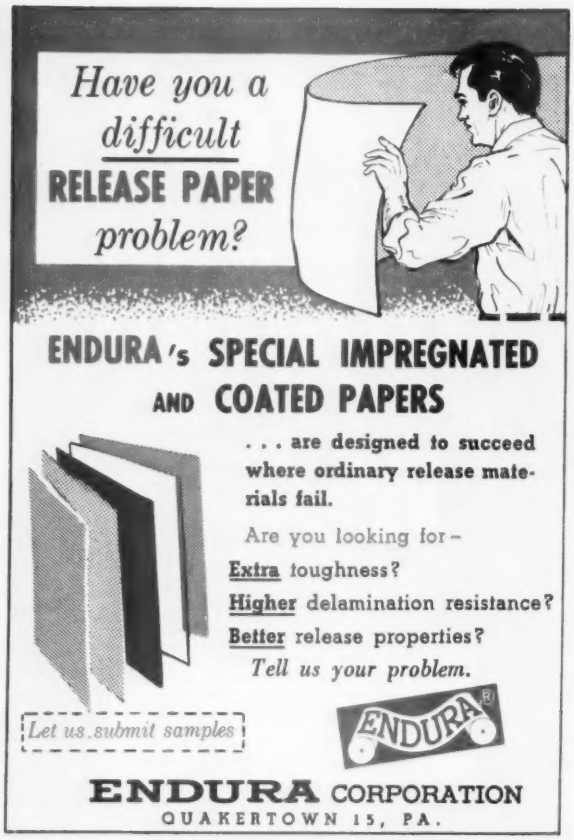
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Dies For Every Conceivable Purpose
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ASSOCIATE:
NEW ERA DIE CO. York County, Red Lion, Pa.

Surgiderm Surgeon's Glove

► A new surgeon's glove, said to reduce hand fatigue by requiring 25 to 30 per cent less energy to flex the fingers and hands than ordinary surgeon's gloves, is in production at the Sundries Division of the B. F. Goodrich Industrial Products Co., Riverside, N. J. Called "Surgiderm", the new glove was introduced early this year as an experimental model under another tradename. According to the company, the glove combines softness, comfort, strength and aging qualities and also reduces hand fatigue.

Goodrich Lawn and Garden Hose

► B. F. Goodrich Industrial Products Co., Akron, Ohio, has announced the development of a lawn and garden hose that is said to combine the lightness of plastic and the toughness of natural rubber. The new hose is named "Golf Course Hose for Home Use", because like golf course hose, it was designed to take the baking action of the sun and the rough treatment of outdoor life, the company says. Made with a special compound of synthetic rubber, the hose has an inner liner of high-grade synthetic rubber that will not absorb water. According to the company, the cover is made of butyl rubber and resists suncheck and cracking, is soft and pliable and prevents stiffness even in cold weather. The hose withstands up to 500 pounds pressure.

Angier Insert-O-Spout

► Angier Adhesives, Division of Interchemical Corp., Cambridge, Mass., has announced the introduction of an inexpensive spout for pouring liquids from drums or pails. Called the "Insert-O-Spout", the new polyethylene spout can be inserted into the opening without tools and can be pushed in and pulled out time after time, according to the company. The screw cap on the container can be put right over it. The new spout is said to be resistant to chemicals and to be perfect for pouring viscous as well as light liquids. It is odorless, tasteless and non-toxic.

Advertisement

Antioxidant for White Drug and Surgical Sundries

Rubber Chemicals Department of American Cyanamid Company has reported outstanding success for Antioxidant 425 in the field of white or light-colored

drug and surgical sundries. Antioxidant 425 was specially developed to give supreme protection against discoloration plus maximum oxidation protection in the very finest white rubbers. It has no effect on plasticity and imparts no odor to rubber stock. Cyanamid offers Antioxidant 425 as "the *ultimate* in non-staining antioxidants for the *ultimate* in white rubber quality."

Non-Discoloring Agent for Rubberized Backings

Loss of sales through the darkening or discoloration of light-colored rubberized backings can now be prevented by Antioxidant 2246, made by American Cyanamid Company. Latex backings containing Antioxidant 2246 retain the sales appeal of their original colors through warehousing or retail storage—customers can be shown products that are bright and new-looking on *both* sides. Antioxidant 2246 is the most active, non-staining, non-discoloring antioxidant commercially available for white or light-colored stocks. Rubberized backings on rugs, upholstery and drapery fabrics will retain their color, strength and flexibility through years of hard service.

Antioxidant KO's Gelling in SBR Mastication

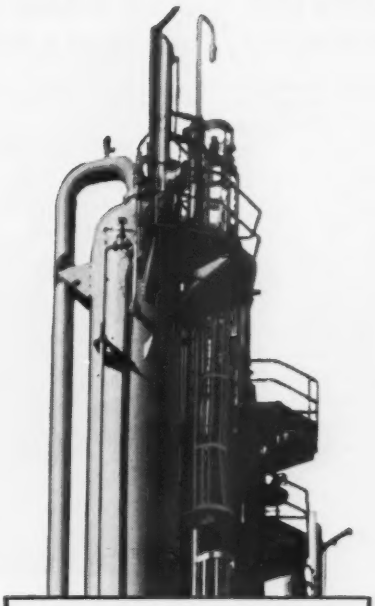
The prevention of gel build-up is important in those applications where good dynamic physical properties are essential. Gel formation, associated with high mastication temperatures in SBR processing, is inhibited by the presence of American Cyanamid's Antioxidant 2246. Low ratios (0.5 to 0.75%) have eliminated gel formation whereas tests on control stocks with no added antioxidant have shown up to 30% gel under the same mastication conditions.

For
Unmatched
Rubber
Whiteness...

... investigate these *unmatched* non-staining antioxidants:

Antioxidant 2246®

Antioxidant 425®



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AMERICAN CYANAMID COMPANY
RUBBER CHEMICALS DEPARTMENT
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DARLINGTON CHEMICALS, INC.

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Represented by • Summit Chemical Co., Akron
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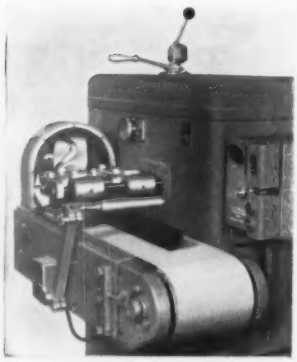

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Let **WINK** Automate Your Molding Preparation and Cut Costs Radically

WINK cuts any extruded material, speeds being controlled automatically to equal extruding speeds; 3000 pieces per minute are possible. Right off the belt, WINK cuts lengths of 100 feet and more from 3" dia. down to thin 1/16" slices on 1/2" dia. stock; *no distortion or collapse.* Set-up time negligible; short runs practical. Waste reduced up to 90%.

Write on your letterhead for Bulletin "A-11"

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Martin Swimming Accessories

► Martin Rubber Co., Long Branch, N. J., has announced the availability of professional type swim fins and masks. Made of Plioflex synthetic rubber, the new European style swimming accessories are said to have won favor among skin divers who enjoy spear fishing.

Fins are manufactured to exhibit the utmost rigidity in the web and yet retain soft, flexible qualities in the heel portion. The company states that the web has the right amount of temper for maximum propulsion and the elastic heel assures fit and comfort. Masks are equipped with a heavy shatter-proof plastic lens and adjustable head straps. A stainless steel band holds the lens in place and has a take-up nut for leakproof adjustments. In addition to its "Flying Fish" line, which is made in glossy black, Martin also produces King Neptune masks and fins in ocean blue and the Rocket line in sea green. Sets consisting of fins, mask and snorkel are also available.

Revelation Tank Wagon Hose

► Hamilton Rubber Manufacturing Corp., division of the Acme-Hamilton Manufacturing Corp., 115 Meade St., Trenton 3, N. J., has announced the availability of a rugged, flexible, easy-to-handle hose for conveying gasoline, oil and other petroleum liquids. Known as the "Hamilton Revelation Tank Wagon Hose", the product is designed for unloading liquid petroleum products from storage tanks, tank cars and tank trucks. Its construction features an oil-resistant tube covered with impregnated plies of horizontally braided cable cord yarns. A conducting wire, included in the braid, handles static electricity. Further hose protection for long wear is provided by an abrasion and oil-resistant cover. Made on steel mandrels, Hamilton Revelation Tank Wagon Hose is said to have a smooth and true inside diameter that assures full-flow, the company says. Available in lengths up to 50 feet, Revelation Tank Wagon Hose comes in four ID sizes ranging from 2 to 4 inches. Working pressures for these sizes range from 108 to 285 psi.

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Adhesive uses include laminating paper for tapes and bagging, fabrics for shoes, and scrap foam or curled hair for cushioning.

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WRITE FOR BULLETIN NO. 126

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ROLL CAMBER ADJUSTED BY FABRIC EDGE GAGE
FOR PRECISE CONTROL OF WIDTH, CENTERING AND EDGE CONDITION OF TIRE FABRICS AND OTHER OPEN WEAVES DURING WEB PROCESSING . . . *Bulletin on Request*

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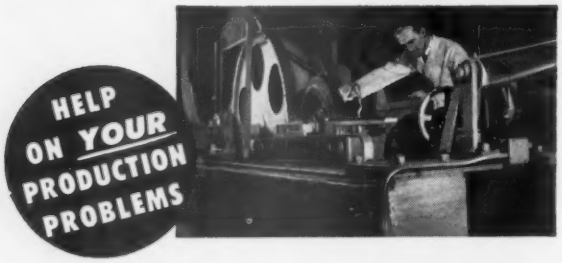

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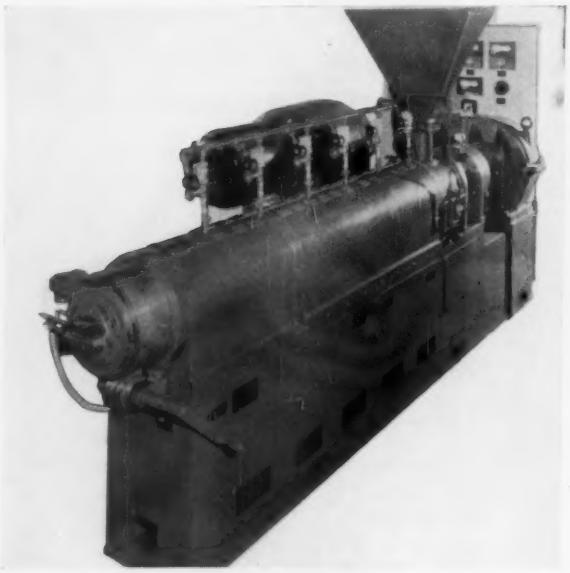
New Equipment

Extruder Temperature Control System

► Hale & Kullgren, Inc., Akron, Ohio, has announced a temperature control system for extruders which utilizes induction heating of the extruder cylinder in combination with water cooling. The accompanying photograph shows



the system attached to an extruder. Demonstrations on a 4½ by 90-inch plastics extruder are said to have shown extremely fast temperature response. It was reported that the machine was brought to operating temperature from a cold start in 20 minutes, using less than one-fourth the energy required for conventional electrically-heated machines. Energy requirements for operation are expected to be in the same proportion. The system can be applied in a wide range of extruder sizes, both for rubber and plastic, and can also be adapted to existing machines where fast temperature response is desirable.

Sinclair-Collins Control Valves

► A full-line of diaphragm-operated control valves with ductile iron bodies for use with high pressure, high temperature hot water has been announced by Sinclair-Collins Valve Co., 454 Morgan Ave., Akron 11, Ohio. Designed for control of rubber molding and similar equipment, the S-C valves are suitable for pressures up to 600 psi and temperatures as high as 350°F. The ductile iron used in the valves is reputed to be much more corrosion-resistant than steel and to have a tensile strength approximately three times that of bronze. The valves are offered in 2-way, 3-way normally open or normally closed and reverse acting types.

EASTMAN "Lightning"
for cutting straight lines and easy curves. Automatic sharpening renews knife while machine is cutting.

It's EASTMAN *for*
QUICK, EASY, ACCURATE
RUBBER CUTTING

- **All types of Rubber—cured and uncured**
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- **Rubber Sheeting and Slabs**

Skivers and Strip-Cutters also available.
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Care to try this Eastman in your own plant?

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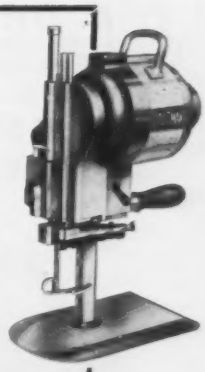
EASTMAN "Blue Streak"
for cutting intricate shapes.

Special knife edges — saw-tooth, wave-edge, etc.—and knife moistening device makes cutting easy. ONLY the Eastman automatic BELT-sharpening can sharpen these knives correctly.



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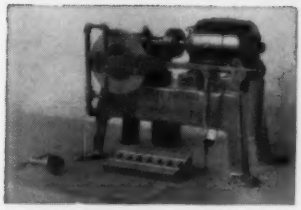

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*Trademark

SCOTT TESTERS, INC.
85 Blackstone St., Providence, R. I.

ALL STEEL, ALL WELDED CONSTRUCTION, with forged steel hubs for 1¼", 1½" and 2" square bars. 4", 5", 6" 8", 10", 12", 15", 20" and 24" diameters. Any length.

Also Special Trucks (Leaf Type) Racks, Tables and Jigs, Used in manufacturing rubber and plastic products.

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Greater Center Drop Range

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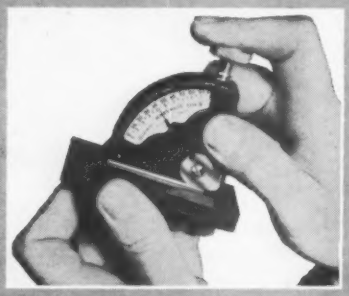

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Also Available in:

ROUND DIAL — MAXIMUM READING — for measuring cold flow or creep.

ROUND DIAL — CONSTANT LOAD — *(with dead weight attachment)* to eliminate variations in readings due to variable pressures in manual application.

The Shore Durometer is available in various models for testing the entire range of rubber hardness and is furnished complete with standard spring block and carrying case.

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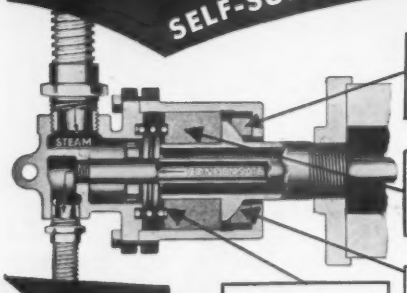
Manufacturers of the "Scleroscope," for testing the hardness of metals.

JOHNSON Rotary Pressure JOINT

SELF-SUPPORTING TYPE



1. **SEAL RING** — of special carbon-graphite. Eliminates packing and oiling.

2. **GUIDE** — Also of carbon-graphite. Makes joint self-supporting.

3. **NIPPLE** — Rotates with roll, seals against ring.

4. **SPRING** — For initial seating only. In operation joint is pressure sealed.

Only 4 Internal Parts

For introducing steam and liquids into rotating rolls and cylinders, there's nothing like the Johnson Joint above. It's packless, self-lubricating, self-adjusting, self-supporting. It has been adopted by dozens of machinery makers, and is finding new uses every day.

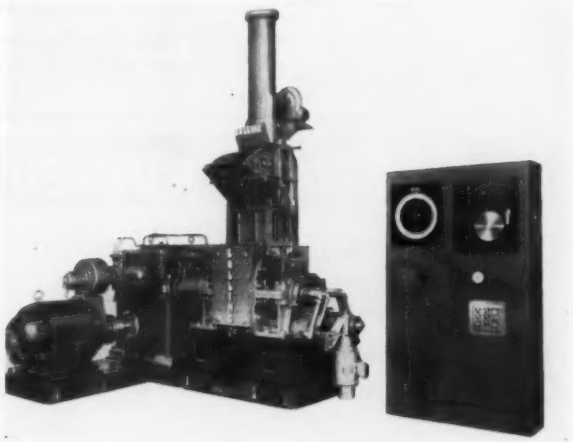
Type SB shown handles both steam and condensate through same head; also available for through flow service, and in sizes and styles for all operating conditions. ***Write for literature.***

The Johnson Corporation

868 Wood St., Three Rivers, Mich.

Laboratory-Production Intensive Mixer

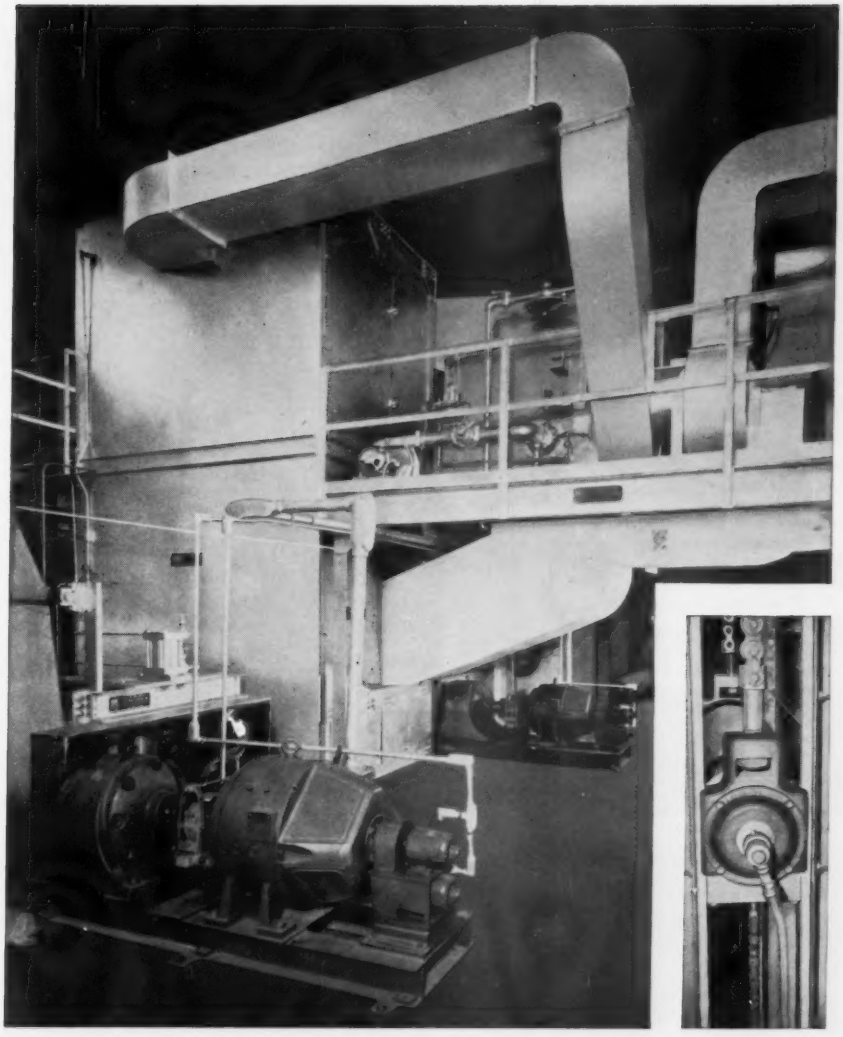
► The No. 1-B Model has been added to the line of intensive mixers produced by Stewart-Bolling & Co., Inc., 3190 East 65th St., Cleveland 27, Ohio. Designed for medium small production and major laboratory work



with rubber and plastics, the mixer is eleven feet high and eight feet wide, not including control panels. Holding capacity is 1200 cubic inches; temperature range extends to 500°F. Batch sizes are from 24 pounds at 1.00 gravity through 45 pounds at 2.00 gravity. Featured are anti-friction rotor journal bearings, split end frames, and Spiral-Flow sides which are designed to heat or cool with optimum efficiency, plus a compound type drive which permits high rotor speeds and power application, but requires little space. A motorized discharge door gives fast, positive action on door openings and closings. All surfaces coming in contact with materials are chrome-plated.

COG Impact-in-Air Comminutor

► COG Corp., 4441 West Lake St., Chicago, Ill., has announced new features in its impact-in-air comminutor. These include "snap apart" construction of all functional parts to permit rapid and thorough cleaning; a rotor reversible on splined shaft for dual purpose blades or extra blade life; construction based on sub-assemblies which provide minimum maintenance, maximum accessibility and many combinations in one basic unit, plus extra safety features. Designed for continuous processes, the machine has units for size reduction of wet or dry products, spray-blending of dry and wet ingredients for intimate blending on a continuous basis while maintaining accurate formula ration, as well as for continuous and intensive blending of several dry ingredients in any ratio. Uses include producing complete solutions, as in making rubber cement, regrinding sheet trim scrap of rubber and other materials, in addition to many others.



Within the first day of startup, full width nylon tire cord processed in this 30-yard-per-minute, 14,000-pound-tension **IOI** Rollevator® Oven*, was made into aircraft tires meeting all qualification tests.

The Rollevator® roll automatically moves up and down within the oven, in direct relation to line speeds. Thus, at *any line speed, heat-exposure* time of the nylon is held *constant* at a constant temperature setting and at constant tension.

Rollevator® Oven* hot stretches nylon tire cord at constant optimum temperature, constant time and constant tension, at variable line speeds

The IOI Rollevator® Oven* is the answer to more uniform hot stretching of nylon with greater production efficiency. Simple and automatic in operation, it practically eliminates costly shutdown and repair time. When the line is stopped the Rollevator® roll automatically lowers out of the heat zone, eliminating the need for quick cool purging of the oven and the time and expense involved in reheating the oven when starting up again. Its low operating cost combined with low initial cost assures you of lower production cost. An IOI sales engineer will be glad to give you complete information about the Rollevator® Oven* and to discuss your requirements for any system from 3 to 100 yards per minute.

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Hand Mallets and Clicker Dies.
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Multiple level trim dies maintain shape of part without distortion.
Air Cylinder equipment. Also dies adaptable to customers punch press.

WESTERN SUPPLIES *Company*
2910 CASS AVE., SAINT LOUIS 6, MO.

Progressive Equipment Flocking Machine

► A compact flocking machine designed to handle a variety of materials has been announced by Progressive Equipment Co., 8625 Mackinaw at Grand River, Detroit, Mich. Called the Peco Model 7, it features a self-contained air supply to prevent overloading of existing

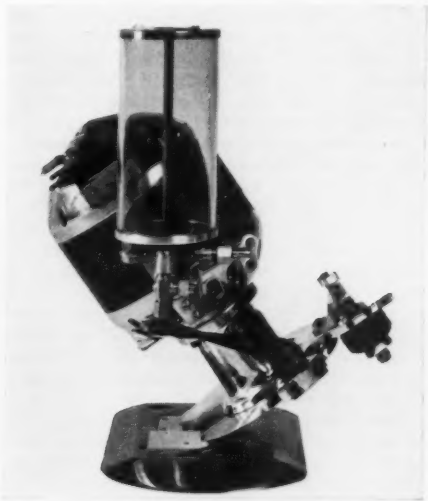
compressors in volume flocking operations. Additional improvements of the new model include a roller chain drive with ball bearing, totally enclosed overload-protected motor, and accessories for special requirements. Dimensions of the machine are 15 x 16 x 39 inches; total weight is less than 100 pounds. A switch on the nozzle at the end of the flexible discharge hose provides fingertip control of the flocking. A cost-cutting feature of the model is the design of the tilting supply hopper which permits quick and easy removal of unused flock.

Sequentrol Program Controller

► A sequence control which regulates a number of functions that must take place in a predetermined order to preset values is manufactured by Jordan Co., 3235 West Hampton Ave., Milwaukee 9, Wisc. Called the Sequentrol, it is suitable for use in dipping machine programming and other processes. A vernier dial or revolution counter type control is set for each position or rate that is to be established, and, in programmed sequence, each dial or counter assumes command of the operation. The Shaftrol, a shaft-mounted gear motor, establishes the position of a tool, setting of a variable speed drive, or other function. Commands may originate from controls set at the device, or from remotely located potentiometers or punch card reading devices. Machines in manual operation are said to be easily converted to automatic sequencing through use of the device.

Eastman Portable Skiving Machine

► Eastman Machine Co., Buffalo 3, N. Y., has introduced its new portable rubber skiving machine, claimed to be the first and only machine that can satisfactorily replace hand-skiving. The machine is said to simultaneously cut and skive slabs of up to one-half inch



thickness of cured and uncured rubber and foam, and to make a uniformly smooth and accurate cut. The bevel is fixed at an angle of 35° off the horizontal. A moistening device controls the proper lubrication of the knife, and an automatic sharpener renews the knife edge as the machine is in operation.

Stencil-type Mask for Spray Decoration

► Rubber balls and other round, cylindrical or semi-spherical shapes can be spray decorated easily and economically by using its new masking method, according to Conforming Matrix Corp., 317 Toledo Factories Building, Toledo 2, Ohio. Bright durable multiple colors are said to be painted with better register and finer definitions. The masks are made of electroformed nickel, which is said to offer the desired qualities of strength and ductility with rigidity and to give extended life.

► Worthington Corp., Harrison, N. J., has introduced a new packaged **water chiller** available in 3 and 5 hp sizes that requires no field refrigerant piping. It is equipped with automatic controls including a freeze-up thermostat to prevent water from freezing within the chiller.

► The Farval Corp., 3249 East 80th St., Cleveland 4, Ohio, manufactures a new type **circulating oil system** under the trade-name Lubrival. It monitors its own operation through a pressure-sensing mechanism to warn of clogged or broken lines in any part of the system.

For grinding, pulverizing, mixing—

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Reviews

BOOKS

Chemistry of Natural and Synthetic Rubbers. By Harry L. Fisher. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. 6 x 9 in. 208 pp. $6.50.

As Dr. Fisher states in his preface, this is a book of facts. To enlarge on this statement, however, it would be more appropriate to say that this is a book of facts on rubber which have been put together in an interesting, readable and useful manner. In short, it is a book on rubber which should prove of direct interest to both the student beginning his studies and the experienced rubber technologist. There has been a dearth of textbooks in the field of rubber and so this new work, prepared by a scientist and teacher who has been associated with the chemistry of rubber for over forty years, is a welcome addition to the technical literature.

The author has not attempted to cover all of the theories and empirical asides involved in the wide complex of the chemistry of natural and synthetic rubbers. Rather he has stuck rather closely to the facts and presented these facts in clear, concise wording, alluding to the theories only where absolutely necessary. Chemical equations have been kept to the minimum and illustrations are utilized to emphasize the text. The latter, incidentally, cover the very latest developments in rubber, including the polyester elastomers, the polyurethane materials and the fluoro rubbers.

The book is divided into 13 chapters covering, respectively, history, vulcanization, acceleration, antioxidants and antiozonants, natural rubber, latex, properties, raw materials, synthetic rubbers, hard rubber, bonding rubber to metal, reclaimed rubber and chemical derivatives. In addition, there are author and subject indexes. Literature references appear at the end of almost every chapter.

Harry Fisher needs no introduction to the rubber industry, having served both as a chairman of the Division of Rubber Chemistry and president of the parent American Chemical Society. This book is typical of the work the industry expects from him. Accordingly, all we can add at this point is: Well Done, Dr. Fisher.

•

Engineering Manpower: How to Improve Its Productivity. Published by Engineering Management Reports, P. O. Box 161, Cambridge 38, Mass. 8½ x 11 in. 162 pp.

One answer to the current shortage of engineers is the more effective use of the engineers available. Written for managers and administrators with the objective of showing in what areas and by what means engineering productivity can be improved, this special report, prepared by a group of nine students at the Harvard University Graduate School of Business Administration, is probably the first fully integrated study of how industry is utilizing and motivating engineers.

Briefly, the authors have simply described what they found to be the philosophy, policies and practices of American industrial concerns toward their technical personnel, have drawn certain conclusions, and have made specific suggestions. The major value of the report lies in the suggestions made and, while they are too numerous for repetition here, we recommend them to executives and administrators in the rubber field who equally face the manpower problem in scientific help. The suggestions cover organization, planning, leadership, working conditions, supporting personnel, hiring, training, personnel administration, compensation and patents.

Some statistics on the preparation of this report are of interest. More than 4,000 manhours were involved. Collectively members of the group preparing the report travelled many hundreds of miles gathering data and information. The heart of the report is based on personal interviews with, and letters from, industrial executives, individual engineers, society representatives, union leaders, and university and government officials. The group involved is to be heartily congratulated.

Underground Systems Reference Book. (2nd Edition). Published by the Edison Electric Institute, 420 Lexington Ave., New York 17, N. Y. 8½ x 11¼ in. 624 pp. $12.50.

The first edition of this reference book, prepared by the Transmission and Distribution Committee of the Edison Electric Institute, was published in 1931. Completely rewritten, the current edition reflects the extensive developments of the past quarter of a century, and represents a comprehensive and practical study of the best practices in design, construction, operation and maintenance of power cable systems. Retaining only a small portion of the original historical information, the new edition is approximately twice as large as the original work, indicative of the tremendous strides which have taken place in power cable systems in the past 25 years, particularly in the field of synthetics.

In addition to a comprehensive introduction, the book contains 15 chapters, each representing the effort of a specialized group of editors. The scope of the work is best indicated by the subject matter of these chapters, as follows: (1) Applications for Cable and Cable Systems; (2) Cable and Cable Insulation; (3) Bulk Power Systems; (4) Underground Radial and Loop Systems; (5) Underground Secondary Networks; (6) Street Lighting Systems; (7) Conduits and Manholes; (8) Cable Installation; (9) Cable Joints and Terminations; (10) Cable and Underground Equipment Loading; (11) Cable Testing, Fault Location and Cable Identification; (12) Records, Repairs and Maintenance; (13) Cable and Equipment Reconditioning; (14) Corrosion; (15) Safety Practices.

References to rubber and the rubberlike materials appear frequently throughout the text, with the major emphasis contained in the chapter on cables and cable insulation. An indication of progress where rubber is concerned is in the statement that whereas the maximum operating voltage for insulated cables a decade ago was approximately 15 kv for rubber insulations, higher ratings for insulated cables are now common, with an occasional one rated as high as 35 kv. The book also refers to the fact that neoprene has largely replaced fabrics as outer protective coverings for non-metallic sheathed cables.

This monumental reference book is essentially a working reference written by engineers for engineers. Like the initial edition, it should prove a valuable working tool to everyone concerned with underground power systems.

•

Practical Programs for Cost Control. Published by the American Management Association, Inc., 1515 Broadway, New York 36, N. Y. 6 x 9 in. 54 pp. $1.75.

Derived from material presented at the Manufacturing Conference held by the American Management Association in March, 1957, this booklet contains descriptions of how various leading companies achieved workable programs for cost control. Three basic programs are covered, namely, coordination of the responsibilities of materials purchasing and materials control; effective maintenance of available tools, materials and manpower, and cutting paperwork costs. In addition, the booklet features four company reports on current practices in engineering management, including one from the Monsanto Chemical Co. Other companies whose activities are outlined include the International Steel Co., Quaker Oats Co. and the Thomas & Betts Co., Inc.

•

Radiation Effects on Materials. Vol. 1. (Special Publication No. 208). Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Penna. 6 x 9 in. 190 pp. $3.50 (members); $4.75 (non-members).

The fifteen papers presented at the Symposium on Radioisotopes and Radiation Effects held by ASTM Committee E-10 at Los Angeles in September, 1956, are reproduced in this book, together with subsequent discussions. It is divided into three parts, namely, Theory of Radiation, Radiation Facilities and Mechanics of Testing, and Experimental Tests and Results. The latter covers fuel and graphite materials and structural materials, including organics. The symposium papers will prove of especial value to those interested in the design and operation of nuclear reactors.

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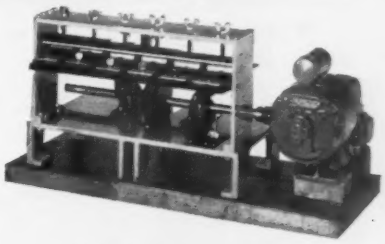

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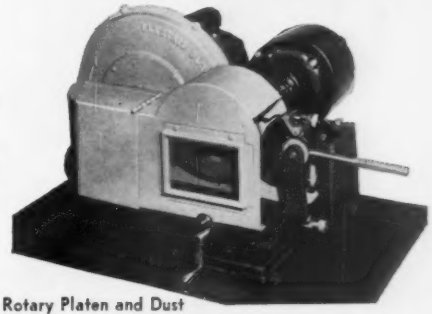

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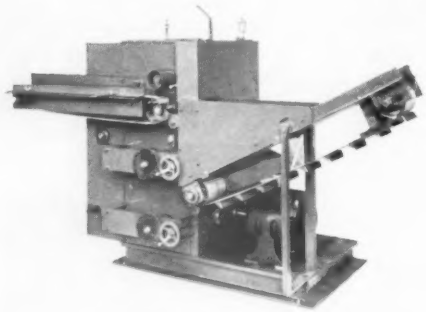

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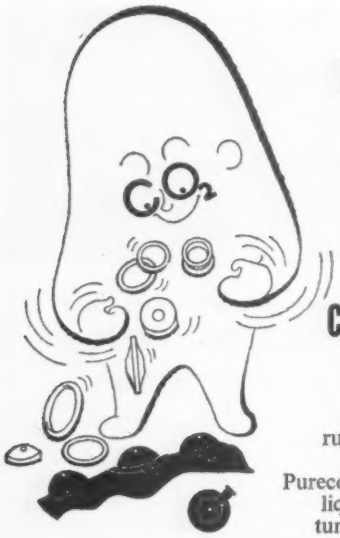

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Butadiene. . . Its Present and Potential Uses. Petro-Tex Chemical Corp., Houston 1, Texas. 8½ x 11 in. 42 pp.

This publication is said to be the first technical manual ever printed on butadiene. Physical properties, polymerization data, chemical properties and detailed information on all principal butadiene reactions are presented. Included are a series of six "family trees" showing the chemical structure of present and potential products resulting from various classes of reactions. The bibliography contains 286 literature references. Much of the data have previously been unavailable because of their development in the synthetic rubber program, and are put into print for the first time in this booklet. A comprehensive exposition of a material of vital interest to the rubber industry, the booklet will prove of value to many. The quality of the printing and design is excellent.

•

Progress Through Research at Air Reduction. Air Reduction Co., Inc., 150 East 42nd St., New York 17, N. Y. 11 x 8½ in. 24 pp.

A review of the research and development activities at Air Reduction's research laboratories at Murray Hill, N. J. is given in this brochure. These are divided into three principal categories: welding and metallurgical, chemical and engineering. The operations are portrayed primarily by photographic illustrations with captions, with subsidiary text material. The work of services and support personnel is also explained. The quality of the photographs is excellent, and they are well chosen to tell the story of the research conducted in the laboratories.

•

Lemol Polyvinyl Alcohols. (Bulletin No. M-13T). Chemical Division, Borden Co., 350 Madison Ave., New York 17, N. Y. 8½ x 11 in. 24 pp.

Lemol polyvinyl alcohols manufactured by Borden are described in this bulletin, which is divided into three parts on "Specifications, Solutions and Compounding," "Properties," and "Industrial Uses." It analyzes in detail the materials, which find applications in molding rubber-type products, emulsifying many oils, plasticizers, solvents and waxes, and many other industrial applications. Graphs, tables and charts aid in the presentation of the data.

•

Genthane-S Polyurethane Elastomer. (Bulletin No. GT-1). Chemical Division, General Tire & Rubber Co., Akron, Ohio. 8½ x 11 in. 20 pp.

This technical brochure on a new polyurethane elastomer, designated Genthane-S, outlines in detail its physical properties and characteristics under various conditions. Fillers, plasticizers, processing and curing are discussed, and test results are shown in a series of graphs and charts. The presentation is complete and concise, making the booklet a good example of a well designed technical publication.

•

Hot Spraying of Hypalon 20 Coatings. (Report BL-330). Prepared by R. R. Radcliff and D. J. Kelly. Elastomer Chemicals Department, E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del. 6¼ x 9½ in. 6 pp.

The advantages of applying Hypalon 20 coatings by the hot spraying method are described in this brochure. Equipment, procedures and applications are explained. Tables and photographs are employed in illustrating the advantages of the hot spraying technique, which include better drying, increased film thickness and a more uniform film.

Building and Equipment Sanitation Maintenance: Principles and Practices. By J. Lloyd Barron and Albert J. Burner. Association of American Soap and Glycerine Producers, Inc., 295 Madison Ave., New York, N. Y. 8¼ x 11 in. 62 pp.

A subject of major importance to industrial operation today is given extensive treatment in this booklet, which views modern sanitation as a highly organized self-contained function performed by trained personnel directly responsible to top management. Discussed are such subjects as the role of sanitation in industry, nature of the cleaning problem, types of cleaning materials, fitting the cleaner to the need, organization of the cleaning program, and determination of costs. Outstanding examples of modern industrial sanitation programs are included. Interesting reading for plant managers and others.

•

Resins for the Rubber Industry. Schenectady Resins Division, Schenectady Varnish Co., Inc., Schenectady 1, N. Y. 8½ x 11 in. 28 pp.

This booklet presents technical data on the phenolic resins manufactured by Schenectady Resins which find application in the rubber industry. It contains two main sections, one on use in rubber compounding and one on use in adhesives. Both contain general data on compounding techniques and uses with natural and various synthetic rubbers. Application charts and product data are included. Each resin is analyzed individually by definition, physical properties, handling characteristics and applications. Photographs of production and research facilities enhance the presentation.

•

Hanna Flo-Pilot Valves. (Catalog No. 262). Hanna Engineering Works, 1765 Elston Ave., Chicago 22, Ill. 8½ x 11 in. 8 pp.

The line of valves manufactured by Hanna Engineering Works is the subject of this catalog. Each of the five basic models—ball cam, palm button, hand lever, locking hand lever and mechanical link clevis—is described and illustrated. Flow and piping arrangements, as well as different types of manual and automatic control circuits utilizing the valves, are depicted with schematic diagrams. A section on how to specify the valves by model and size when ordering closes the booklet.

•

Let Wink Aid Your Automation. (Bulletin No. 101). F. J. Fink & Co., 221 Cherry St., Chardon, Ohio. 8½ x 11 in. 4 pp.

This bulletin is devoted to the Wink line of equipment for cutting of extruded material. Various machines and their component parts are illustrated by photographs: models of the cutters, photo-electric measuring equipment, a feed and metering unit, clutches, knives, and special equipment to meet specific requirements. Text is used to explain the machines and their operation, and to detail their advantages.

•

Neopentyl Glycol. (TDR No. N-101). Eastman Chemical Products, Inc., Kingsport, Tenn. 8½ x 11 in. 8 pp.

This technical data booklet describes neopentyl glycol (2,2-dimethyl-1,3-propenediol) which is newly available in commercial quantities. Various applications, including use in polymeric plasticizers and polyurethane foams, are discussed. Uses of unsaturated polyester resins derived from neopentyl glycol are also given. Properties of the 5-carbon glycol are presented in detail.

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Natural Rubber

Since our last report (October 1), the price of spot rubber on the New York Commodity Exchange has moved in a range of 200 points, high for the period being 30.00c reached on October 2, and low being 28.00c reached on October 28 and again on October 30. The average price of spot rubber for the month of October was 29.24c based upon 23 trading days. This compares with an average of 29.94c in the previous month.

Uppermost in the minds of the rubber trade abroad, and for that matter here, is the question of the U.S. rubber stockpile. The trade is well aware of the requirements in connection with liquidation of strategic stockpile commodities. Uneasiness does exist, however, in that Washington has become more and more economy minded.

A re-appraisal of the stockpile of strategic commodities now underway does not necessarily mean a reduction. The feeling has developed, however, that the outcome of the study will mean some reductions in the rubber stockpile.

In any event, developments along this line will be a dominating factor in shaping the trend of rubber prices. During the period, the New York market broke to new lows despite the absence of pressure from actual rubber. Consumers showed very little interest and trading in actual rubber was very light in spite of the low price structure.

World Production Higher

Merrill Lynch, Pierce, Fenner & Beane analysts point out that International Rubber Study Group statistics for the first eight months of this year indicate that world natural rubber production was some 30,000 tons higher than in the comparable period of the preceding year, but world consumption in the same period was off by about 14,000 tons. Stocks of crude rubber throughout the world represent only about 4½ months' supply in terms of previous 12 months' consumption. This is similar to a year ago.

In view of monetary problems and improved distribution, such a level of stocks is probably quite normal, but a few years ago it would have been called low. If anything, MLPFB analysts state, stocks in terms of today's conditions are a little high in producer areas and normal to a little low in consumer areas. However, only a steady or barely steady level consumption of natural is expected for the next few years.

Lower Natural Consumption

Last year, the U.S. consumed 562,000 long tons of natural rubber. This year's total is expected to be about 545,000 long tons. At the present time, the outlook for the automobile industry in 1958 seems to indicate little change from the 1957 figures. Some improvement, however, is expected in replacement tire shipments. In this light, U.S. use of natural in 1958 might reach 540,000 long tons, or might drop to 510,000 long tons. At any rate, natural rubber will have a battle on its hands because 1958 will see major increases in synthetic capacity.

NEW YORK, NOVEMBER 1, 1957

Price Data

Closing Rubber Prices on New York Commodity Exchange

FROM OCTOBER 1 TO OCTOBER 31

Oct.	Spot	Nov.	Jan.	Mar.	May	Sales
1	29.88	29.80	29.81	29.87	29.85	101
2	30.00	30.05	29.95	29.95	29.95	102
3	29.88	29.80	29.75	29.70	29.65	63
4	29.63	29.65	29.61	29.60	29.60	20
5	....	....	....	....	....	...
6	....	....	....	....	....	...
7	29.63	29.65	29.62	29.60	29.60	7
8	29.75	29.65	29.68	29.60	29.60	95
9	29.63	29.65	29.61	29.55	29.55	55
10	29.63	29.60	29.50	29.50	29.50	60
11	29.50	29.55	29.45	29.50	29.41	31
12	....	....	....	....	....	...
13	....	....	....	....	....	...
14	29.50	29.54	29.44	29.45	29.40	21
15	29.50	29.44	29.40	29.40	29.40	37
16	29.50	29.50	29.35	29.35	29.40	39
17	29.88	29.90	29.92	29.90	29.93	88
18	29.63	29.60	29.60	29.60	29.60	32
19	....	....	....	....	....	...
20	....	....	....	....	....	...
21	29.13	28.95	28.96	29.00	28.99	96
22	28.75	28.60	28.70	28.65	28.65	125
23	29.00	28.90	28.91	28.93	28.93	80
24	29.00	28.85	28.90	28.92	28.95	31
25	28.50	28.35	28.40	28.50	28.50	90
26	....	....	....	....	....	...
27	....	....	....	....	....	...
28	28.00	27.85	28.00	28.10	28.05	85
29	28.33	28.00	28.30	28.30	28.30	73
30	28.00	27.60	27.95	27.98	27.97	63
31	28.33	28.20	28.25	28.30	28.30	81

Outside Market

No. 1 Ribbed Smoked Sheets:	
Spot	.28
Dec.	.28
Jan.	.28
Thin Latex Crepe:	
Spot	.31
Thin Brown Crepe, No. 2	.25½
Flat Bark Crepe	.21⅜

London Market (Standard Smoked Sheets)

Jan.-Mar.	27.95 - 28.10
Apr.-June	28.10 - 28.25

Singapore Market (Standard Smoked Sheets)

Dec.	26.47 - 26.55

Middling Upland Quotations

	Oct. 1	November 1		
	Close	High	Low	Close
Dec.	34.09	34.92	34.75	34.89
Mar.	34.27	35.03	34.86	34.98
May	34.05	35.03	34.87	35.01

Notes & Quotes

The nation's motorists will spend nearly $1.5 billion for replacement passenger tires duirng 1957 but even that large expenditure will represent only $1 out of every $200 spent for consumer goods this year, E. F. Tomlinson, president of the B. F. Goodrich Tire Co., stated recently. Mr. Tomlinson said that replacement passenger tire sales in 1958 are expected to be 6 per cent higher than in 1957. By the end of 1958, he said, nearly 54 million passenger cars will be traveling the nation's roads and highways. At the moment, 12 per cent of American families are two-car owners. In ten years, 20 per cent of U.S. families will have at least two cars, if present trends continue. Mr. Tomlinson believes that tire dealers' business should grow about 6 per cent in 1958.

Synthetic Rubber

Analysts for Merrill Lynch, Pierce, Fenner & Beane note that in the past few years, shipments of synthetic rubber abroad and plant capacities overseas have both increased, the former spectacularly. There is good indication that natural will continue to lose ground in consumption abroad next year even though in the rest of the world use should rise about 50,000 long tons, about the same amount we expect in the United States.

Not only has synthetic rubber set another record in its preference in the U.S., but it is doing the same abroad. In September, the ratio struck 64.02 per cent, making the year to that point strike an average of 63.04 against 60.61 per cent in the corresponding period of the previous year.

It is estimated that the percentage for calendar 1957 will be about 63.3 per cent and next year 64 to 65 per cent. In the rest of the free world, the following has been the record and the expectation: The synthetic preference ratio was 12 per cent in 1955, 16.3 per cent in 1956, probably close to 18.6 per cent this year, and over 20 per cent in 1958.

World Ratio Climbing

For the entire free world, the synthetic preference ratio has been climbing at a fairly steady pace: 1955, 36.2 per cent; 1956, 37.4 per cent; 1957, 39.7 per cent; 1958, over 41 per cent. This is all rather disconcerting to natural rubber. Given an increase of 100,000 long tons in world new rubber consumption, over 80,000 long tons would go to synthetic even if only a 1 per cent preference ratio increase were given to synthetic rubber.

Some authorities predict that 1958 will record the biggest annual increase in synthetic rubber capacity so far, both in the United States and abroad. It is not unlikely that next year world capacity may be increased as much as 30 per cent.

If such a step does materialize, and if war does not occur, and finally if the world automobile outlook does not change, we will have left the era of close balance between supply and demand and will enter a period of surplus availability.

Two other factors bear examination at this point. It should be noted that as far as price is concerned, natural prices are down nearly to their synthetic equivalents in Europe, when one considers the delivered price of synthetic there. Secondly, a change in stockpile policy in the United States may do much to change the natural-synthetic relationship structure. Finally, if dollar shortages continue to develop in Europe, and elsewhere in the world for that matter, there may be a turn to natural rubber.

Chemical-Natural Rubber

Added to the above, moreover, is the prospect of a truly effective natural-synthetic rubber, and this technological development may do much to alter existing relationships. The least that can be said, however, is that synthetic rubber is, at the moment, in a desirable position—a position it will not relinquish readily.

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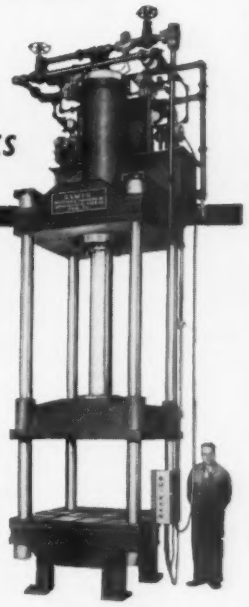

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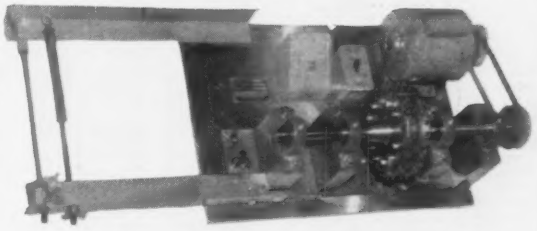

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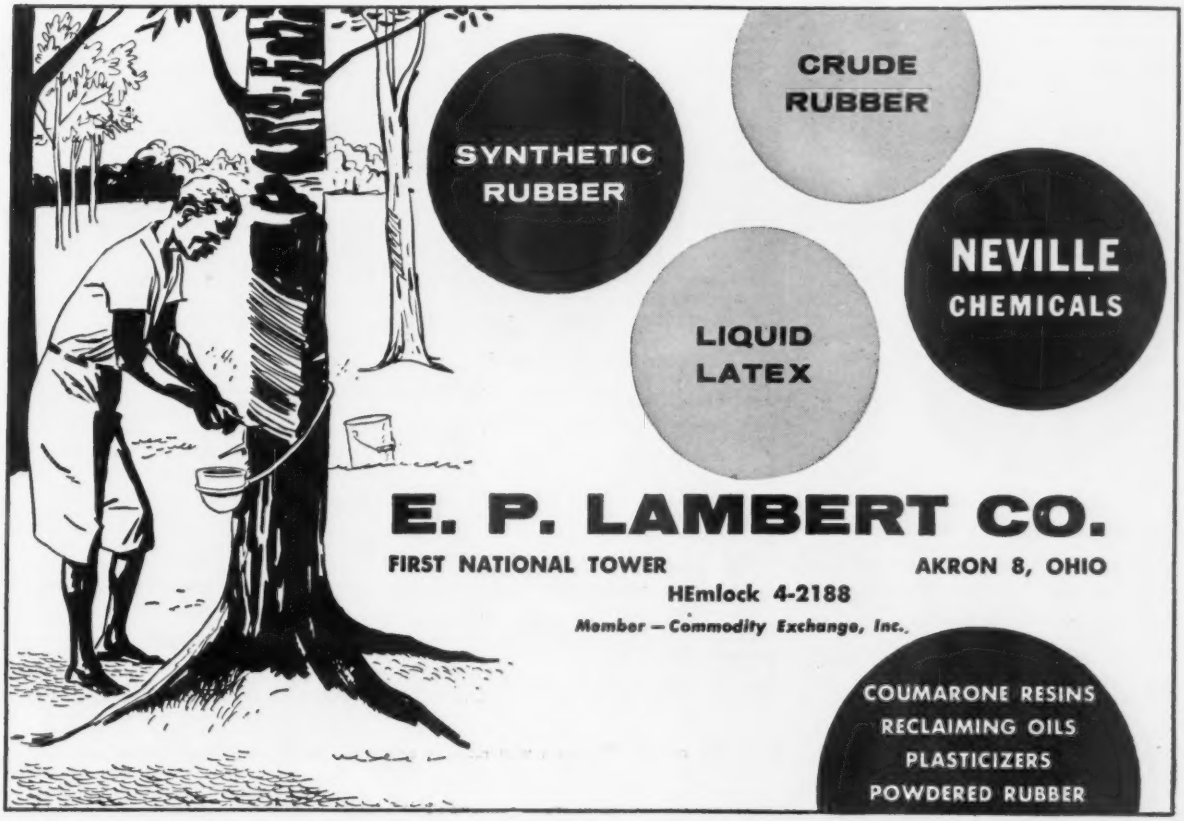
FERRY MACHINE CO., KENT, OHIO

Export Sales Through Columbian Carbon, In't'l, N. Y.



E. P. LAMBERT CO.

FIRST NATIONAL TOWER AKRON 8, OHIO

HEmlock 4-2188

Member — Commodity Exchange, Inc.

COUMARONE RESINS
RECLAIMING OILS
PLASTICIZERS
POWDERED RUBBER

PRICES OF COMMERCIALLY AVAILABLE SYNTHETIC RUBBER POLYMERS

(dry types—per pound carload unless otherwise specified)

Butadiene-Acrylonitrile Types

Butaprene NAA	.5400 [1]
Butaprene NF	.4900 [1]
Butaprene NL	.5000 [1]
Butaprene NXM	.5800 [1]
Chemigum N1	.6400 [3]
Chemigum N3 and N5	.5800 [3]
Chemigum N6 and N7	.5000 [3]
Herecol N-33	.6800 [2]
Hycar 1001	.5800 [2]
Hycar 1002	.5000 [2]
Hycar 1014	.6000 [2]
Hycar 1041	.5800 [2]
Hycar 1042 and 1043	.5000 [2]
Hycar 1312	.5000 [2]
Hycar 1411	.6200 [2]
Hycar 1432	.5900 [2]
Hycar 1441	.6200 [2]
Paracril AJ	.4850 [2]
Paracril B	.5000 [2]
Paracril BJ	.5000 [2]
Paracril BLT	.5000 [2]
Paracril C	.5800 [2]
Paracril CV	.5900 [2]
Paracril D	.6500 [2]
Paracril 18-80	.6000 [2]
Polysar Krynac 800	.5000 [2]
Polysar Krynac 801	.5800 [2]
Polysar Krynac 802	.5000 [2]
Polysar Krynac 803	.5000 [2]

Butadiene-Styrene Types

Ameripol 1000	.2410 [3]
Ameripol 1001	.2410 [3]
Ameripol 1002	.2435 [3]
Ameripol 1006	.2410 [3]
Ameripol 1007	.2425 [3]
Ameripol 1009	.2475 [3]
Ameripol 1500	.2410 [3]
Ameripol 1501	.2410 [3]
Ameripol 1502	.2410 [3]
Ameripol 1703	.2060 [3]
Ameripol 1705	.2035 [3]
Ameripol 1707	.1910 [3]
Ameripol 1708	.1910 [3]
Ameripol 1710	.1885 [3]
Ameripol 1712	.1885 [3]
ASRC 1000	.2410 [3]
ASRC 1001	.2410 [3]
ASRC 1004	.2410 [3]
ASRC 1006	.2410 [3]
ASRC 1009	.2475 [3]
ASRC 1018	.2700 [3]
ASRC 1019	.2650 [3]
ASRC 1500	.2410 [3]
ASRC 1502	.2410 [3]
ASRC 1503	.2625 [3]
ASRC 1703	.2060 [3]
ASRC 1708	.1910 [3]
ASCR 3110	.2600 [3]
Baytown 1600	.1760 [2]
Baytown 1601	.1760 [2]
Baytown 1602	.1760 [2]
Baytown 1801	.1600 [2]
Copo 1500	.2410 [3]
Copo 1502	.2410 [3]
Copo 1505	.2610 [3]
Copo 1712	.1885 [3]
FR-S 1000	.2410 [3]
FR-S 1001	.2410 [3]

Butadiene-Styrene (Cont'd)

FR-S 1004	.2410 [3]
FR-S 1006	.2410 [3]
FR-S 1009	.2475 [3]
FR-S 1010	.2600 [3]
FR-S 1012	.2425 [3]
FR-S 1013	.2500 [3]
FR-S 1014	.2810 [3]
FR-S 1015	.2910 [3]
FR-S 1500	.2410 [3]
FR-S 1502	.2410 [3]
FR-S 1703	.2060 [3]
FR-S 1705	.2035 [3]
FR-S 1712	.1885 [3]
Naugapol 1016	.2650 [3]
Naugapol 1018	.2700 [3]
Naugapol 1019	.2650 [3]
Naugapol 1021	.3000 [3]
Naugapol 1022	.2800 [3]
Naugapol 1023	.2850 [3]
Naugapol 1503	.2625 [3]
Naugapol 1504	.2950 [3]
Philprene 1000	.2410 [1]
Philprene 1001	.2410 [1]
Philprene 1006	.2410 [1]
Philprene 1009	.2475 [1]
Philprene 1010	.2600 [1]
Philprene 1018	.2700 [1]
Philprene 1019	.2650 [1]
Philprene 1100	.1940 [1]
Philprene 1104	.1900 [1]
Philprene 1500	.2410 [1]
Philprene 1502	.2410 [1]
Philprene 1503	.2625 [1]
Philprene 1600	.1930 [1]
Philprene 1601	.1930 [1]
Philprene 1605	.1900 [1]
Philprene 1703	.2060 [1]
Philprene 1706	.2030 [1]
Philprene 1708	.1910 [1]
Philprene 1712	.1885 [1]
Philprene 1803	.1740 [1]
Plioflex 1006	.2410 [3]
Plioflex 1500	.2410 [3]
Plioflex 1502	.2410 [3]
Plioflex 1703	.2060 [3]
Plioflex 1710	.1885 [3]
Plioflex 1712	.1885 [3]
Plioflex 1773	.2060 [3]
Plioflex 1778	.1910 [3]
Polysar Kryflex 200	.2410 [3]
Polysar Krylene	.2410 [3]
Polysar Krylene NS	.2410 [3]
Polysar Krynol 651	.1885 [3]
Polysar Krynol 652	.1910 [3]
Polysar S	.2410 [3]
Polysar S-50	.2410 [3]
Polysar S-X 371	.2550 [3]
Polysar SS-250	.3000 [3]
S-1000	.2300 [2]
S-1001	.2300 [2]
S-1002	.2325 [2]
S-1006	.2300 [2]
S-1011	.2325 [2]
S-1013	.2300 [2]
S-1100	.1850 [2]
S-1500	.2300 [2]
S-1502	.2300 [2]
S-1600	.1825 [2]
S-1601	.1825 [2]
S-1602	.1825 [2]

Butadiene-Styrene (Cont'd)

S-1703	.1950 [2]
S-1706	.1925 [2]
S-1707	.1800 [2]
S-1709	.1775 [2]
S-1712	.1775 [2]
S-1801	.1675 [2]
Synpol 1000	.2410 [1]
Synpol 1001	.2410 [1]
Synpol 1002	.2435 [1]
Synpol 1006	.2410 [1]
Synpol 1007	.2410 [1]
Synpol 1009	.2475 [1]
Synpol 1012	.2425 [1]
Synpol 1013	.2500 [1]
Synpol 1061	.2410 [1]
Synpol 1500	.2410 [1]
Synpol 1502	.2410 [1]
Synpol 1551	.2410 [1]
Synpol 1703	.2060 [1]
Synpol 1707	.1910 [1]
Synpol 1708	.1910 [1]
Synpol 1711	.1900 [1]

Butyl Rubbers

Enjay Butyl 035	.2300 [2]
Enjay Butyl 150	.2300 [2]
Enjay Butyl 165 NS	.2400 [2]
Enjay Butyl 215	.2300 [2]
Enjay Butyl 217	.2300 [2]
Enjay Butyl 218	.2300 [2]
Enjay Butyl 268 NS	.2400 [2]
Enjay Butyl 325	.2300 [2]
Enjay Butyl 365 NS	.2400 [2]
Polysar Butyl 100	.2450 [2]
Polysar Butyl 101	.2775 [2]
Polysar Butyl 200	.2450 [2]
Polysar Butyl 300	.2450 [2]
Polysar Butyl 301	.2550 [2]
Polysar Butyl 400	.2450 [2]

Neoprene

	(prices l.c.l.)
Neoprene Types AC and CG	.5500 [2]
Neoprene Type GN	.4100 [2]
Neoprene Type GN-A	.4100 [2]
Neoprene Type GRT	.4200 [2]
Neoprene Type KNR	.7500 [2]
Neoprene Type S	.4200 [2]
Neoprene Type W	.3900 [2]
Neoprene Type WHV	.3900 [2]
Neoprene Type WRT	.4500 [2]
Neoprene Type WX	.4100 [2]

Silicone Rubbers*

	(prices l.c.l.)
GE (compounded)	2.50 [2]
GE Silicone Gum (not compounded)	4.00 [2]
Silastic (compounded)	1.90 [2]
Silastic (gums)	3.85 [2]
Union Carbide (gums)	4.00 [2]
Union Carbide (compounds)	2.50 [2]

Polysulfide Rubbers

	(prices l.c.l.)
Thiokol Type A	.4700 [2]
Thiokol Type FA	.6400 [2]
Thiokol FR-1	.9500 [2]
Thiokol Type ST	1.00 [2]

(latices—all prices per pound dry weight)

Butadiene-Acrylonitrile Types

Butaprene N-300	.4600 [1]
Butaprene N-400	.5400 [1]
Butaprene N-401	.5400 [1]
Chemigum 200	.4900 [3]
Chemigum 235	.5400 [3]
Chemigum 236	.5400 [3]
Chemigum 245	.4600 [3]
Chemigum 246	.4600 [3]
Hycar 1512	.4600 [3]
Hycar 1551	.5400 [3]
Hycar 1552	.4600 [3]
Hycar 1561	.5400 [3]
Hycar 1562	.4600 [3]
Hycar 1571	.5400 [3]
Hycar 1572	.5100 [3]
Hycar 1577	.4600 [3]
Hycar 1852	.4600 [3]

Butadiene-Styrene Types

Copo 2101	.3000 [3]
Copo 2102	.3200 [3]

Butadiene-Styrene (Cont'd)

Copo 2105	.3200 [3]
Copo X-765	.3000 [3]
FR-S 2000	.2600 [3]
FR-S 2001	.2600 [3]
FR-S 2002	.2850 [3]
FR-S 2003	.2950 [3]
FR-S 2004	.2950 [3]
FR-S 2006	.2600 [3]
FR-S 2105	.3100 [3]
Pliolite 2101	.3000 [3]
Pliolite 2104	.3200 [3]
Pliolite 2105	.3200 [3]
Pliolite X-765	.3000 [3]
Naugatex 2000	.2630 [3]
Naugatex 2001	.2630 [3]
Naugatex 2002	.2880 [3]
Naugatex 2006	.2630 [3]
Naugatex 2105	.3120 [3]
Naugatex X-765	.2900 [3]
Naugatex X-767	.3120 [3]

Butadiene-Styrene (Cont'd)

S-2000	.2275 [3]
S-2006	.2150 [3]
S-2101	.2250 [3]
S-2105	.3100 [3]

Neoprene

Neoprene Latex 60	.4000 [3]
Neoprene Latex 571	.3700 [3]
Neoprene Latex 572	.3900 [3]
Neoprene Latex 601-A	.4000 [3]
Neoprene Latex 735	.3800 [3]
Neoprene Latex 736	.3800 [3]
Neoprene Latex 842-A	.3700 [3]
Neoprene Latex 950	.4700 [3]

Polysulfide Rubbers

Thiokol Type MX	.7000 [3]
Thiokol Type WD-2	.9200 [3]
Thiokol Type WD-6	.7000 [3]

Notes: (1) Freight allowed. (2) Freight extra. (3) Freight prepaid. *Covers a wide range of compounds. Readers are urged to check specific prices with producers.

MARKETS

(continued)

Reclaimed Rubber

The latest figures available from the Rubber Manufacturers Association indicate that in the first nine months of the current year, a total of 203,094 long tons of reclaimed rubber were produced in the United States, while some 137 long tons were imported and 10,467 long tons exported. This left a total new supply of 192,764 long tons.

In the first nine months of this year, a total of 203,994 long tons of reclaim were consumed, while stocks as of September 30 stood at 25,271 long tons, a decline of about 3,000 long tons from the end of the previous month.

It will be seen from these figures that the United States is consuming about 22,500 long tons of reclaimed rubber a month leading to a possible yearly total of some 270,000 long tons. This will place consumption in 1957 at just about the point it maintained in the previous year and, as a matter of fact, would be slightly better than expectations earlier in the year. From this viewpoint, it may be said that 1957 will be a "satisfactory" if not a "good" year for the industry.

(Prices for All Areas Except Calif.)

	per lb.
Premium Grade Whole Tire	.11½
First Line Whole Tire	.11
Second Line Whole Tire	.10½
Third Line Whole Tire	.10¼
Fourth Line Whole Tire	.09¾
Black Carcass	.15¼
No. 1 Light Colored Carcass	.22
No. 1 Peel	.11
Butyl Tube Reclaim	.14
Natural Rubber Black Tube	.16
Natural Rubber Red Tube	.21
Natural Rubber Gray Tube	.21

Scrap Rubber

There has been a slight pick-up of activity in the scrap rubber market during the past period, mainly because of orders placed for mixed automobile tires for November shipment. Business in the remainder of the market, including tubes, generally was of a routine nature. Reports indicate that there has been more activity in the midwest than in the east.

Scrap rubber exports in August showed a slight increase over July, according to statistics made available by the Bureau of the Census. August shipments to overseas' destinations totaled 6,890,929 pounds valued at $231,603, compared with 6,885,170 pounds worth $195,534 in July.

RMA reports that in the first nine months of 1957, 180,391 long tons of scrap rubber were consumed in the U.S. As of September 30, 1957, there were 81,604 long tons of scrap rubber in stocks.

(Prices Delivered Akron)

Mixed tires	ton	15.50
Light colored carcass	lb.	.05½
No. 1 peelings	ton	35.00
No. 2 peelings	ton	28.00
No. 3 peelings	ton	20.00
Buffings	ton	16.00
Truck and Bus S.A.G.	ton	19.00
Passenger S.A.G.	ton	17.50
Natural Rubber Red Tubes	lb.	.08
Natural Rubber Black Tubes	lb.	.07
Butyl Rubber Tubes	lb.	.04½

Tire Fabrics

According to current reports, competition between various types of textiles, plastics and paper is becoming more intense in the auto interior field, with auto manufacturers scheduled to use a variety of such materials in their 1958 models. Until about five or six years ago, woven textiles held sway over the auto interior market. Within the past few years this situation has changed rapidly, as woven fabrics gave way before lower priced and more efficient competitive materials. For example, knitted fabrics began to be used as backing for vinyl plastic and quickly replaced a considerable volume of woven goods which were previously used for this purpose.

Non-woven fabrics also replaced lightweight woven fabrics for sidepaneling but in the last two years have been replaced, in turn, by unsupported vinyl film and coated paper. Ford is reported planning to use unsupported vinyl for sidepaneling in 1958 models. General Motors, on the other hand, is favoring coated paper.

Non-Woven Fabrics Gaining

Non-woven fabrics, however, are gaining for use as a backing for vinyl plastic in auto seat upholstery, offering increasing competition to knitted fabrics. This year, the big three in the auto industry will be using woven, knitted and non-woven fabrics in varying quantities.

Producers of non-woven fabrics are confident that they will be able to capture a substantial part of the upholstery market in the years ahead. This, it is hoped, will make up for the losses suffered since 1956 to unsupported vinyl film and paper.

Both knitted and non-woven fabrics offer a greater amount of elasticity than woven goods as a base for vinyl coating, and this makes for easier tailoring and better fit.

Buying Relatively Slow

Buying of all auto interior fabrics this year, however, has been relatively slow, with auto producers buying much more closely than in previous years. Normally, mills should have contracts on their books for delivery well into or through the first quarter on woven, knitted or non-woven fabrics.

While there has been a modest pick-up in recent weeks, with orders placed in good volume for broken twills, most contracts still call for deliveries not much beyond 30 to 60 days ahead.

(Prices f.o.b. Shipping Point)

Rayon Tire Cord

1100	lb.	.73
1650	lb.	.67
2200	lb.	.67½

Nylon Tire Cord

210	lb.	1.95
840	lb.	1.80

Rayon Graded Fabric

100	lb.	.69
1650	lb.	.63½
2200	lb.	.63

Cotton Chafers

8.9 oz. (per square yard)	lb.	.68
9.25 oz. (per square yard)	lb.	.66
11.65 oz. (per square yard)	lb.	.62
14.4 oz. (per square yard)	lb.	.71

Liquid Latex

Natural: Rubber Manufacturers Association reports that in the first five months of the current year, a total of 55,628 long tons of Hevea latex were imported into the United States. Of this sum, 1,091 long tons were re-exported, leaving a total net new supply of 54,537 long tons. In the first nine months of this year, 56,493 long tons of natural rubber latex were consumed, and stocks at the end of the period stood at 12,299 long tons, more than 1,000 tons less than at the end of the previous month.

Natural rubber latex is currently selling at about a 36c a pound level at East Coast ports in tank car lots and at these price levels it would not be surprising if consumption were to show some increases in the next few weeks. It now appears likely that some 75,000 long tons of natural rubber latex will be consumed in 1957.

Synthetic: In the first eight months of this year, 49,450 long tons of S-type latex were produced in the United States, against the 44,291 long tons produced in the comparable period of the preceding year. In the eight month period of this year, 43,853 long tons were consumed, against 42,400 in the first eight months of 1956. It thus appears likely that some 74,000 long tons of S-type latex will be produced in 1957, and some 66,000 consumed. If this comes about, 1957 production will be considerably in excess of the previous year, but consumption will be only slightly so.

As it now stands, about 9,000 long tons more natural latex than synthetic latex will be consumed in 1957 so that in this segment at least, natural still enjoys an advantage. In the face of these figures, and in consideration of the fact that synthetic latex enjoys a price advantage over its natural counterpart, it can only be assumed that natural latex is still held to be superior to synthetic in many quarters.

Cotton

The price of middling uplands on the New York Cotton Exchange has moved in the rather narrow range of 70 points since our last report (October 1), high for the period being 35.40c reached on October 25, and low being 34.70c reached on October 1. The average price of middling uplands for the month of October was 35.09c based on 23 trading days. This compares with an average of 34.74c in the previous month.

According to the Textile Economics Bureau, the production of raw cotton throughout the world in the 1957 season aggregated 36,700,000 bales, a decline of 1,200,000 bales or 3 per cent from the record 1956 seasonal output of 37,900,000 bales. In the United States, production at 13,100,000 bales was down 1,600,000 bales or 11 per cent, while output in all other countries increased 400,000 bales or 1½ per cent to a total of 23,600,000 bales.

In the latest season, the U.S. thus accounted for 36 per cent of world cotton output compared with 39 per cent in 1956. However, both of these shares are notably below the 54 per cent representation in the 1950 season.

The decline in the U.S. share of world cotton production is basically attributed to acreage restrictions that have been in effect over the past several years as well as the increases in foreign cotton output.

STATISTICS of the industry

PERTINENT INDUSTRY DATA

Natural Rubber in the United States

(Including Latex and Guayule)

(All Quantities in Long Tons)

Year	New Supply	Consumption	Re-Exports	Stocks On Hand at End of Period
1931	501,788	355,200	25,609	322,000
1932	414,668	336,700	20,937	379,000
1933	418,902	412,400	20,576	365,000
1934	463,018	462,500	23,856	355,000
1935	467,146	495,500	11,391	303,000
1936	488,145	575,000	12,582	223,000
1937	600,479	543,600	7,902	262,204
1938	411,983	437,031	5,652	231,500
1939	499,473	592,000	13,125	125,800
1940	818,243	648,500	7,060	288,864
1941	1,029,007	775,000	5,376	533,344
1942	282,653	376,791	10,856	422,714
1943	55,329	317,634	20,815	139,594
1944	107,834	144,113	9,665	93,650
1945	135,672	105,429	6,743	118,715
1946	400,687	277,597	4,338	237,467
1947	688,354	562,661	4,101	129,038
1948	735,227	627,332	6,673	141,541
1949	660,792	574,522	6,253	106,619
1950	802,249	720,268	8,644	89,215
1951	733,048	454,015	2,603	76,569
1952	805,997	453,846	3,024	95,260
1953	647,150	553,473	8,376	112,316
1954	596,848	596,285	7,443	104,543
1955	635,174	634,800	10,611	110,105
1956	580,510	563,095	11,300	115,949
1956:				
Aug.	40,367	46,091	759	97,967
Sept.	42,974	44,179	1,184	98,069
Oct.	52,638	52,188	1,543	94,508
Nov.	49,757	42,946	707	106,316
Dec.	57,653	45,227	912	115,949
1957:				
Jan.	46,349	52,631	691	101,758
Feb.	37,487	46,427	693	100,253
Mar.	40,680	48,263	1,218	97,820
Apr.	59,896	45,368	530	102,796
May	52,566	46,385	738	98,817
June	30,290	41,282	859	90,694
July	44,760	39,789	483	98,871
Aug.	48,951	44,846	1,000	98,782

Source: U. S. Department of Commerce.

U. S. Imports of Natural Rubber

Year	Dry: Long Tons	Dry: Declared Value	Latex: Long Tons	Latex: Declared Value	Total Imports
1936	467,064	152,072,496	19,852	6,659,899	486,916
1937	574,600	237,307,041	23,185	10,213,670	597,785
1938	397,640	125,373,864	11,944	4,168,127	409,584
1939	469,946	167,586,780	27,437	10,467,552	497,383
1940	781,202	303,308,823	33,789	14,593,466	814,991
1941	989,498	401,976,317	34,797	15,965,627	1,024,245
1942	266,276	112,537,426	10,646	5,630,667	276,922
1943	50,358	31,369,198	1,890	1,312,202	52,248
1944	103,847	73,908,549	3,091	2,092,211	106,938
1945	134,408	95,814,102	4,773	3,115,853	139,181
1946	376,502	228,796,110	8,421	5,843,085	384,923
1947	691,087	306,951,814	17,542	9,787,722	708,629
1948	702,293	290,849,177	32,745	18,288,223	735,038
1949	630,808	225,343,624	29,743	14,968,650	660,551
1950	747,109	416,222,598	54,401	41,764,486	801,510
1951	677,874	727,343,348	54,963	80,178,309	732,837
1952	756,987	578,179,519	48,228	40,563,116	805,215
1953	571,635	284,909,223	75,511	46,353,333	647,146
1954	522,364	219,098,143	74,483	42,755,029	596,847
1955	542,507	360,435,303	92,825	80,163,114	635,332
1956	499,479	334,990,045	71,709	61,795,844	564,321
1956:					
July	37,673	22,164,793	3,522	2,539,365	41,195
Aug.	35,652	19,703,676	4,715	3,277,700	40,367
Sept.	40,184	23,453,972	2,790	2,207,011	42,974
Oct.	40,690	28,494,068	5,738	4,341,172	46,428
Nov.	44,995	26,695,282	4,761	3,698,504	49,756
Dec.	50,992	31,077,000	6,661	5,170,306	57,653
1957:					
Jan.	39,889	24,412,461	6,461	5,203,207	46,350
Feb.	33,145	21,603,218	4,342	3,491,712	37,487
Mar.	34,824	22,769,949	7,336	5,193,356	42,160
Apr.	51,084	31,631,505	8,812	6,608,083	59,896
May	46,772	26,960,166	5,794	4,309,057	52,566
June	25,481	15,262,392	4,810	3,605,798	30,291
July	38,517	23,567,902	6,243	4,721,139	44,760

Source: Bureau of the Census, U. S. Department of Commerce.

World Production of Natural Rubber

(Including Latex)

(Long Tons)

Year	Malaya	Indonesia	Ceylon	Viet Nam & Cambodia	Latin America	Rest of World*	Total*
1945	8,600*	10,000*	97,500	12,000*	47,125	73,570	250,000
1946	403,719	175,000*	94,000	19,975	39,678*	105,080	837,500
1947	646,362	277,951	89,000	38,128	34,928*	172,782	1,260,000
1948	698,189	432,349	95,000	43,935	29,158*	225,557	1,525,000
1949	671,503	432,996	89,500	43,010	27,318*	225,659	1,490,000
1950	694,090	696,472	113,500	48,482	26,902*	280,299	1,860,000
1951	605,346	814,406	105,000	52,136	29,777*	278,262	1,885,000
1952	584,238	750,494	96,500	63,134	35,475*	261,211	1,790,000
1953	574,390	692,164	98,610	74,545	35,318*	250,182	1,725,000
1954	584,435	738,670	93,935	78,024	26,833*	280,112	1,802,500
1955	639,128	733,786	93,830	80,172	6,000*	344,584	1,897,500
1956	568,550	686,667	95,389	89,072	22,457	336,015	1,857,000
1957:							
Jan.	63,449	46,437	8,793	8,341	4,042	26,492	157,500
Feb.	49,115	37,035	4,565	894	2,713	28,178	122,500
Mar.	47,029	65,740	5,733	3,562	3,438	39,498	165,000
Apr.	49,091	61,140	7,317	6,306	2,706	23,440	150,000
May	45,519	48,455	7,359	6,996	....	26,671	135,000
June	51,295	49,970	6,510	....	....	37,225	145,000
July	56,538	86,863	9,551	....	....	37,048	190,000

Source: International Rubber Study Group. * Estimated.

World Consumption of Natural and Synthetic Rubber

(Including Latex)

(Long Tons)

Year	United States	United Kingdom	Canada	Europe*	Rest of World*	Total*
1944	710,783	86,977	34,310	132,500	160,690	1,125,000
1945	799,009	91,047	41,836	87,500	108,164	1,127,500
1946	1,039,296	126,770	39,196	145,000	115,804	1,467,500
1947	1,122,327	156,399	61,452	242,500	153,548	1,735,000
1948	1,069,404	196,286	62,121	392,000	182,379	1,902,500
1949	988,903	186,622	56,362	446,500	207,388	1,887,500
1950	1,258,557	222,425	68,695	448,500	287,055	2,285,000
1951	1,214,298	238,101	70,809	476,500	314,941	2,312,500
1952	1,261,413	202,179	67,099	550,000	254,901	2,335,000
1953	1,338,309	211,453	73,394	521,000	343,606	2,500,000
1954	1,233,012	247,612	71,656	544,250	408,094	2,505,000
1955	1,529,699	266,804	84,528	630,000	464,250	2,980,000
1956	1,436,482	232,345	91,458	775,500	489,215	3,025,000
1957:						
Jan.	138,121	18,104	8,242	62,250	33,033	262,500
Feb.	123,687	18,378	7,995	60,750	43,940	255,000
Mar.	129,913	22,967	7,883	71,000	44,987	275,000
Apr.	121,723	17,533	7,596	74,000	125,648	272,500
May	126,753	19,341	8,319	65,000	113,087	267,500
June	111,738	22,745	7,628	....	112,889	255,000
July	109,660	18,246	....	....	122,094	250,000

Source: International Rubber Study Group. * Estimated.

Rim Production

	1952	1953	1954	1955	1956
Passenger Car	24,936,844	31,318,461	25,952,322	38,092,080	27,109,610
Truck & Bus	5,752,674	5,228,321	4,463,689	6,642,329	6,315,428
Agricultural	2,073,116	1,943,487	1,297,040	1,931,768	1,416,938
Earth Mover	31,791	24,685	21,536	38,859	88,812
Total	32,794,425	38,514,954	31,734,587	46,705,036	34,930,788

	1957 Apr.	May	June	July	Aug.	Sept.
Passenger Car	2,665,142	2,411,221	2,181,799	1,991,321	2,349,616	1,600,648
Truck & Bus	569,917	482,508	400,345	413,057	395,313	385,062
Agricultural	151,134	117,837	106,479	98,547	72,373	71,383
Earth Mover	8,040	6,231	3,862	9,470	3,680	5,575
	2,394,233	3,020,436	2,692,485	2,512,395	2,820,982	2,062,668

Source: The Tire & Rim Association, Inc.

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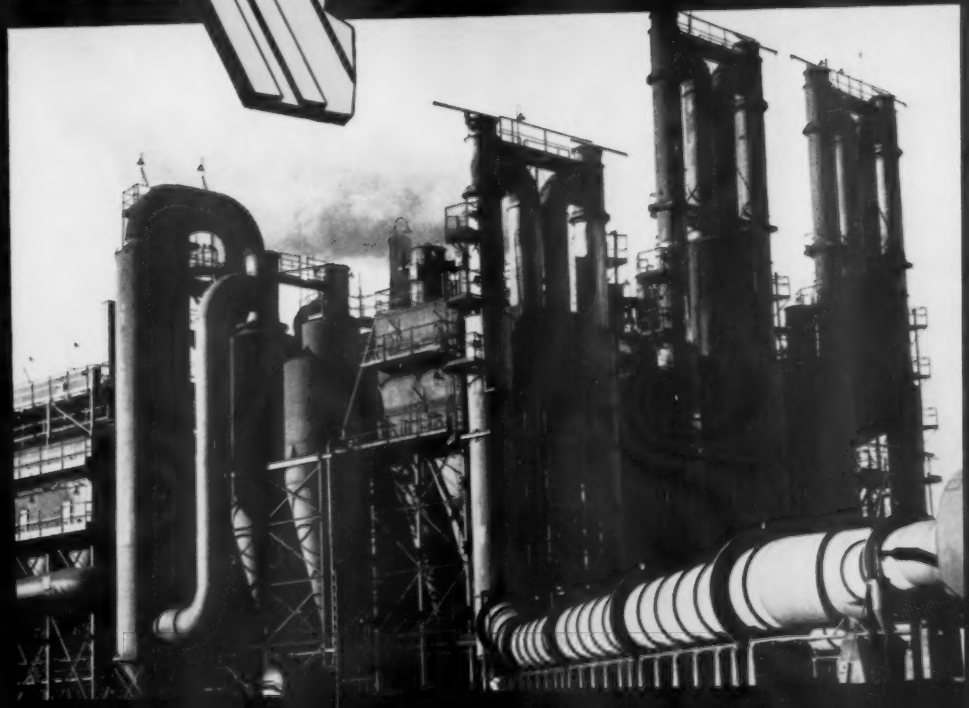

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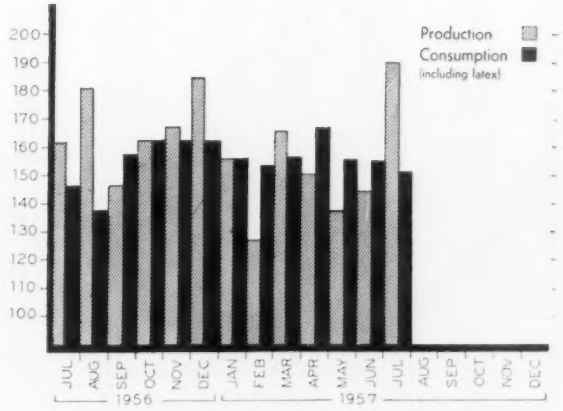
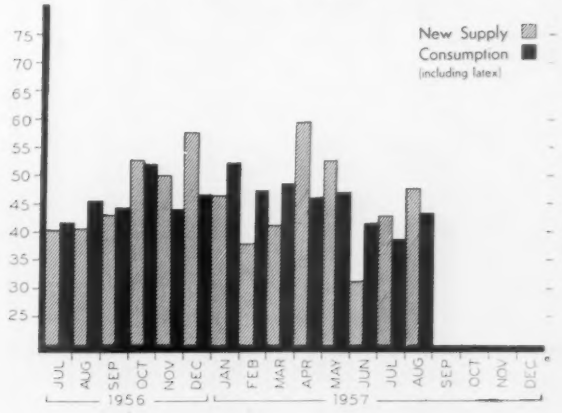
STATISTICS at a glance

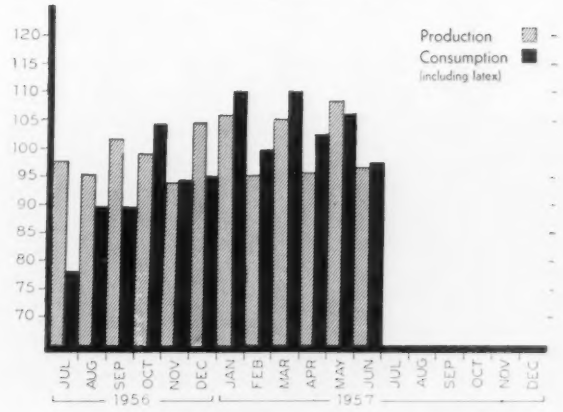
NATURAL RUBBER—WORLD
(thousands of long tons)



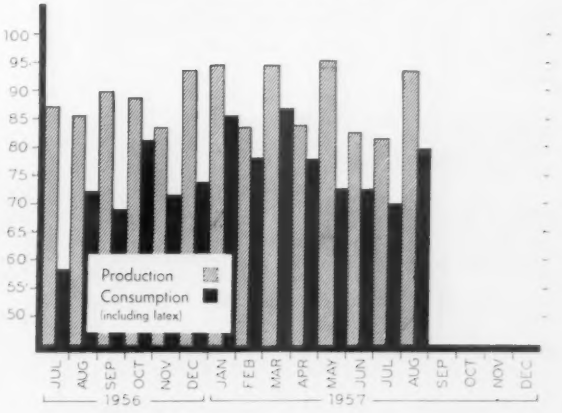
NATURAL RUBBER—UNITED STATES
(thousands of long tons)



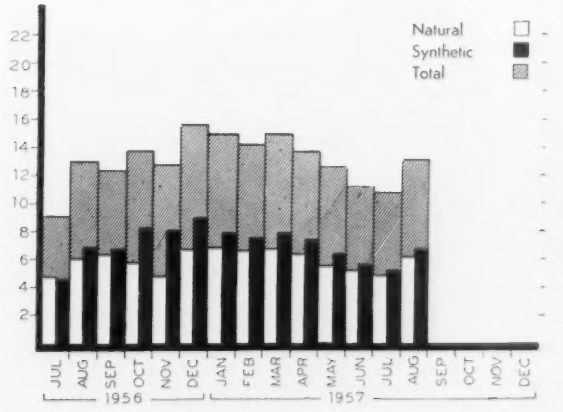
SYNTHETIC RUBBER—WORLD
(thousands of long tons)



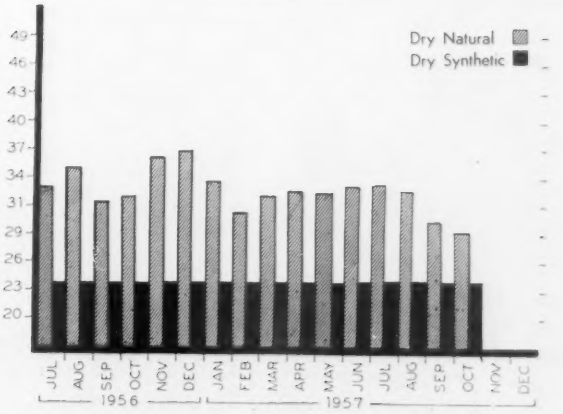
SYNTHETIC RUBBER—UNITED STATES
(thousands of long tons)



LATEX CONSUMPTION—UNITED STATES
(thousands of long tons)



PRICES—NATURAL AND SYNTHETIC
(cents per pound)



Synthetic Rubber in the United States

(All Quantities in Long Tons)

New Supply

Year	GR-S	Neoprene	Butyl	N-Type	Total
1949	**310,529**	**35,215**	**54,046**	**11,072**	**410,932**
1950	**378,887**	**50,067**	**60,915**	**12,037**	**501,906**
1951	**704,529**	**58,907**	**76,475**	**15,333**	**855,244**
1952	**654,854**	**65,745**	**81,630**	**16,228**	**818,447**
1953	**680,728**	**80,495**	**79,801**	**20,198**	**861,222**
1954	**490,405**	**69,150**	**58,802**	**21,396**	**639,753**
1955	801,145	91,357	56,179	32,623	982,304
1956	876,982	99,412	75,873	34,547	1,086,814
1956:					
Oct.	70,690	8,144	7,018	2,973	88,825
Nov.	66,482	8,614	6,065	3,092	84,253
Dec.	76,056	8,828	6,447	2,881	94,212
1957:					
Jan.	76,224	9,432	6,366	2,957	94,999
Feb.	66,023	9,004	5,664	2,963	83,654
Mar.	76,546	8,031	6,460	3,320	94,357
Apr.	65,706	8,902	5,890	2,449	82,947
May	77,542	9,235	6,145	2,597	95,519
June	68,297	9,678	4,474	2,576	85,025
July	68,295	8,591	2,007	2,617	81,710
Aug.	76,197	9,033	5,455	2,737	93,422

Consumption

1950	**416,230**	**43,781**	**66,348**	**11,930**	**538,289**
1951	**626,444**	**48,887**	**70,500**	**13,066**	**758,897**
1952	**666,420**	**55,522**	**71,229**	**13,866**	**807,037**
1953	**624,181**	**65,900**	**77,826**	**16,929**	**784,836**
1954	**500,345**	**57,203**	**61,464**	**17,715**	**636,727**
1955	741,997	72,876	53,991	26,035	894,899
1956	727,789	74,887	49,615	24,976	877,267
1956:					
Oct.	67,399	7,478	4,780	2,366	82,023
Nov.	58,692	6,676	4,093	2,065	71,526
Dec.	61,503	5,991	3,848	1,936	73,278
1957:					
Jan.	70,978	7,237	5,028	2,247	85,490
Feb.	64,322	6,235	4,581	2,122	77,260
Mar.	67,853	6,559	4,998	2,240	81,650
Apr.	63,280	6,295	4,651	2,129	76,355
May	66,774	6,441	4,902	2,125	80,242
June	58,479	5,816	4,198	1,963	70,456
July	58,021	5,231	4,146	1,646	69,044
Aug.	65,825	6,545	4,491	2,154	79,015

Exports

1949	**1,401**	**3,330**	**178**	**1,574**	**6,483**
1950	**900**	**4,826**	**31**	**1,895**	**7,652**
1951	**483**	**6,825**	**216**	**1,725**	**9,249**
1952	**9,467**	**9,813**	**126**	**2,695**	**22,101**
1953	**7,692**	**11,494**	**237**	**3,245**	**22,668**
1954	**11,069**	**12,062**	**2,831**	**4,155**	**30,117**
1955	60,704	18,098	9,895	4,593	93,290
1956	112,366	21,909	8,699	6,194	149,168
1956:					
Nov.	4,789	1,056	247	551	6,643
Dec.	15,268	1,829	1,316	860	19,273
1957:					
Jan.	13,989	2,500	207	540	17,236
Feb.	13,353	2,505	439	482	16,779
Mar.	13,664	2,466	1,014	781	17,925
Apr.	10,625	2,244	372	620	13,861
May	12,208	2,480	603	517	15,808
June	13,886	2,315	762	492	17,455
July	14,444	3,426	1,169	631	19,670

Stocks

1949	**77,731**	**4,654**	**12,224**	**3,433**	**98,042**
1950	**36,942**	**5,733**	**7,243**	**2,840**	**52,758**
1951	**105,271**	**8,379**	**12,481**	**3,821**	**129,912**
1952	**83,861**	**8,535**	**22,716**	**3,875**	**118,987**
1953	**135,153**	**11,480**	**24,866**	**4,346**	**175,845**
1954	**115,499**	**11,349**	**19,267**	**4,280**	**150,395**
1955	108,989	12,220	10,500	6,030	137,739
1956	151,763	14,077	28,744	7,934	202,518
1956:					
Oct.	151,646	12,841	25,734	7,567	197,788
Nov.	151,143	13,459	26,998	7,734	199,334
Dec.	151,763	14,077	28,744	7,934	202,518
1957:					
Jan.	143,177	13,073	29,810	7,664	193,724
Feb.	134,587	12,705	29,951	7,565	184,808
Mar.	131,255	11,949	30,814	7,795	181,813
Apr.	122,764	12,064	31,536	7,247	173,611
May	121,638	13,010	31,812	6,981	173,441
June	120,694	13,822	31,569	7,085	173,230
July	113,143	15,172	28,208	7,125	163,648
Aug.	112,676	14,592	28,408	6,784	162,459

Source: U. S. Department of Commerce.

Natural and Synthetic Rubber Latex in the United States

(All Quantities in Long Tons)

New Supply

Year	Natural	GR-S	Neoprene	N-Type	Total Synthetic	Grand Total
1945	**4,768**	**15,176**	**7,077**	.....	**22,253**	**27,021**
1946	**8,012**	**24,810**	**13,595**	.....	**38,405**	**46,417**
1947	**17,675**	**22,474**	**6,089**	.....	**28,563**	**46,238**
1948	**32,630**	**21,494**	**5,022**	.....	**26,516**	**59,146**
1949	**29,974**	**21,357**	**3,651**	.....	**25,008**	**54,982**
1950	**54,401**	**31,339**	**5,725**	.....	**37,064**	**91,465**
1951	**54,963**	**32,972**	**6,866**	**2,948**	**42,786**	**97,749**
1952	**48,228**	**42,273**	**7,598**	**4,164**	**54,035**	**102,263**
1953	**75,511**	**48,112**	**9,026**	**5,844**	**62,982**	**138,493**
1954	**74,483**	**48,379**	**8,214**	**6,866**	**63,459**	**137,942**
1955	**92,754**	**69,364**	**10,432**	**10,798**	**90,594**	**183,348**
1956	**72,013**	**69,720**	**10,642**	**10,650**	**91,012**	**163,025**
1956:						
July	3,522	4,241	444	731	5,416	8,938
Aug.	4,715	4,902	882	684	6,468	11,183
Sept.	2,790	5,723	1,180	938	7,841	10,631
Oct.	5,738	6,122	908	1,183	8,213	13,951
Nov.	4,762	6,053	886	1,175	8,114	12,876
Dec.	6,661	7,101	967	1,012	9,080	15,741
1957:						
Jan.	6,460	7,270	905	960	9,135	15,595
Feb.	4,342	6,491	724	1,035	8,250	12,592
Mar.	5,856	7,268	924	1,127	9,319	15,175
Apr.	8,812	6,348	976	881	8,205	17,017
May	5,794	5,495	1,082	933	7,510	13,304
June	4,809	5,241	819	886	6,946	11,755
July	6,243	4,646	572	844	6,062	12,305
Aug.	6,834	6,816	874	608	8,298	15,132

Consumption[1]

1945	**3,886**	**14,500**	**6,800**	....	**21,300**	**25,186**
1946	**5,714**	**23,500**	**13,000**	....	**36,500**	**42,214**
1947	**13,909**	**22,500**	**6,500**	....	**29,000**	**42,909**
1948	**28,489**	**21,500**	**5,250**	....	**26,750**	**55,239**
1949	**36,117**	**21,500**	**3,750**	....	**25,250**	**61,367**
1950	**56,138**	**31,000**	**5,500**	....	**36,500**	**92,638**
1951	**46,750**	**31,031**	**6,279**	**2,628**	**39,938**	**86,688**
1952	**53,567**	**40,562**	**7,368**	**3,093**	**51,023**	**104,590**
1953	**67,375**	**46,473**	**7,981**	**3,654**	**58,108**	**125,483**
1954	**75,931**	**44,173**	**7,251**	**4,507**	**55,931**	**131,862**
1955	**86,478**	**63,982**	**8,736**	**8,495**	**81,213**	**167,691**
1956	**74,082**	**62,762**	**8,708**	**8,021**	**79,491**	**153,573**
1956:						
July	4,855	3,731	562	466	4,759	9,614
Aug.	6,374	5,055	816	698	6,569	12,943
Sept.	6,233	4,937	692	699	6,328	12,561
Oct.	7,825	6,175	795	681	7,651	15,476
Nov.	6,431	5,406	723	659	6,788	13,219
Dec.	6,648	5,781	676	597	7,054	13,702
1957:						
Jan.	6,994	6,288	856	841	7,985	14,979
Feb.	6,398	5,894	758	708	7,360	13,758
Mar.	7,081	6,370	784	799	7,953	15,034
Apr.	6,434	5,554	772	710	7,036	13,470
May	5,867	5,114	814	731	6,659	12,526
June	5,445	4,790	736	610	6,136	11,581
July	5,180	4,269	677	480	5,426	10,606
Aug.	6,549	5,574	791	626	6,991	13,540

Stocks at End of Period

1945	**3,121**	....	....	....	....	**3,121**
1946	**4,865**	....	....	....	....	**4,865**
1947	**5,033**	....	....	....	....	**5,033**
1948	**11,235**	....	....	....	....	**11,235**
1949	**5,063**	....	....	....	....	**5,063**
1950	**4,927**	....	....	....	....	**4,927**
1951	**4,752**	**3,727**	**1,245**	**532**	**5,504**	**10,256**
1952	**6,201**	**5,040**	**1,019**	**902**	**6,961**	**13,162**
1953	**13,532**	**4,794**	**1,117**	**721**	**6,632**	**20,164**
1954	**11,133**	**5,134**	**1,087**	**811**	**7,032**	**18,165**
1955	**13,203**	**6,980**	**1,236**	**1,807**	**10,203**	**23,406**
1956	**12,064**	**7,451**	**1,384**	**1,558**	**10,393**	**22,457**
1956:						
July	19,952	7,288	1,109	2,009	10,406	30,358
Aug.	18,099	6,402	1,076	1,703	9,181	27,280
Sept.	15,403	6,625	1,328	1,523	9,476	24,879
Oct.	12,322	5,703	1,263	1,680	8,646	20,968
Nov.	11,148	6,282	1,233	1,939	9,454	20,602
Dec.	12,064	7,451	1,384	1,558	10,393	22,457
1957:						
Jan.	11,831	7,191	1,329	1,936	10,456	22,287
Feb.	9,940	7,415	1,169	2,051	10,635	20,575
Mar.	10,173	7,689	1,170	2,157	11,016	21,189
Apr.	12,064	8,096	1,183	1,836	11,115	23,179
May	11,733	7,885	1,407	1,710	11,002	22,735
June	10,931	8,139	1,377	2,001	11,517	22,448
July	12,073	8,045	1,296	1,953	11,294	23,367
Aug.	13,528	8,398	1,202	1,180	10,780	24,308

Source: U. S. Department of Commerce.
Note: (1) GR-S and Neoprene consumption estimated through 1950.

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Rubber Industry Employment Earnings and Hours

All Rubber Products

Mo.	1956 Production Workers (thousands)	1956 Average Weekly Earnings	1956 Average Weekly Hours	1956 Average Hourly Earnings	1957 Production Workers (thousands)	1957 Average Weekly Earnings	1957 Average Weekly Hours	1957 Average Hourly Earnings
Jan.	229.5	$87.91	40.7	$2.16	216.0	91.21	40.9	2.23
Feb.	224.5	85.81	40.1	2.14	212.6	90.80	40.9	2.22
Mar.	220.8	84.93	39.5	2.15	211.4	89.28	40.4	2.21
Apr.	218.7	85.79	39.9	2.15	191.3	87.60	40.0	2.19
May	216.0	86.18	39.9	2.16	204.2	88.80	40.0	2.22
June	208.5	84.93	39.5	2.15	196.8	91.21	40.9	2.23
July	208.0	86.15	39.7	2.17	199.9	93.11	41.2	2.26
Aug.	210.8	87.64	40.2	2.18	204.2	....	...	...
Sept.	215.4	89.51	40.5	2.21	....	....	...	...
Oct.	220.0	90.17	40.8	2.21	....	....	...	...
Nov.	198.9	88.29	40.5	2.18	....	....	...	...
Dec.	221.5	93.15	41.1	2.25	....	....	...	...
Tires and Tubes								
Jan.	93.7	101.00	40.4	2.50	87.4	107.64	41.4	2.60
Feb.	93.2	97.71	39.4	2.48	86.8	106.19	41.0	2.59
Mar.	92.6	97.25	38.9	2.50	86.9	102.40	40.0	2.56
Apr.	91.8	98.00	39.2	2.50	71.1	103.46	40.1	2.58
May	91.6	99.65	39.7	2.51	84.9	103.46	40.1	2.58
June	90.1	98.25	39.3	2.50	78.2	107.23	41.4	2.59
July	90.0	98.14	39.1	2.51	84.4	109.88	42.1	2.61
Aug.	89.8	101.20	40.0	2.53	....	....	...	...
Sept.	91.6	102.51	40.2	2.55	....	....	...	...
Oct.	91.7	102.66	40.1	2.56	....	....	...	...
Nov.	74.8	103.53	40.6	2.55	....	....	...	...
Dec.	93.2	109.25	41.7	2.62	....	....	...	...
Rubber Footwear								
Jan.	21.0	74.37	40.2	1.85	18.3	71.76	39.0	1.84
Feb.	20.9	74.74	40.4	1.85	17.8	72.10	39.4	1.83
Mar.	20.7	71.34	39.2	1.82	17.8	72.68	39.5	1.84
Apr.	20.3	72.25	39.7	1.82	17.5	70.64	38.6	1.83
May	20.0	72.25	39.7	1.82	17.3	71.92	39.3	1.83
June	19.4	70.53	39.4	1.79	17.4	72.29	39.5	1.83
July	18.9	71.28	39.6	1.80	16.9	71.74	39.2	1.83
Aug.	19.2	70.35	39.3	1.79	....	....	...	...
Sept.	19.3	71.71	39.4	1.82	....	....	...	...
Oct.	91.1	71.71	39.4	1.82	....	....	...	...
Nov.	18.7	71.55	39.1	1.83	....	....	...	...
Dec.	18.4	73.26	39.6	1.85	....	....	...	...
All Other Rubber Products								
Jan.	114.8	79.73	41.1	1.94	110.3	81.39	40.9	1.99
Feb.	110.4	77.95	40.6	1.92	108.0	81.18	41.0	1.98
Mar.	107.5	76.99	40.1	1.92	106.7	81.19	40.8	1.99
Apr.	106.6	77.95	40.6	1.92	102.7	79.60	40.2	1.98
May	104.4	76.99	40.1	1.92	102.0	79.80	40.1	1.99
June	99.0	76.02	39.8	1.91	101.2	81.81	40.7	2.01
July	99.1	77.78	40.3	1.93	98.6	82.42	40.8	2.02
Aug.	101.8	78.76	40.6	1.94	....	....	...	...
Sept.	104.5	81.18	41.0	1.98	....	....	...	...
Oct.	109.2	82.98	41.7	1.99	....	....	...	...
Nov.	105.4	79.98	40.6	1.97	....	....	...	...
Dec.	109.9	82.59	41.5	1.99	....	....	...	...

Source: U. S. Department of Labor.

Note: Data are based upon reports from cooperating establishments covering both full and part-time employees who work during, or received pay for, any part of the pay period ending nearest the 15th of the month. These employment series have been adjusted to first quarter 1954 benchmark levels indicated by data from government social insurance programs. Hours and earnings data pertain only to production and related workers.

Spot Closing Cotton Prices

(Middling Upland Grade—New York Market—in Cents)

Average Monthly Price Per Pound

	1950	1951	1952	1953	1954	1955	1956	1957
Jan.	31.89	45.04	42.96	33.24	34.15	35.07	35.24	34.82
Feb.	32.79	(a)	41.64	33.76	35.00	35.04	36.26	34.82
Mar.	32.65	46.06	41.70	34.10	35.23	34.33	36.70	35.35
Apr.	33.23	46.06	41.79	33.85	35.22	34.23	36.81	35.43
May	33.64	46.06	39.98	34.30	35.34	34.80	36.65	35.40
June	34.61	46.06	41.31	34.11	35.17	34.83	36.67	35.45
July	38.11	46.21	40.37	34.20	35.37	34.61	35.43	35.49
Aug.	38.93	35.93	40.42	33.82	35.19	34.53	34.31	35.15
Sept.	41.62	36.20	39.75	33.69	35.46	33.85	34.35	34.74
Oct.	40.66	38.13	37.52	33.53	35.24	33.93	34.45	35.09
Nov.	43.11	42.70	35.59	33.60	34.80	34.87	34.56	....
Dec.	43.37	43.32	33.76	33.52	35.03	34.95	34.56	....
Average for Year	37.05	42.43	39.71	33.81	35.10	34.59	35.50	....

Note: The Government established a ceiling of 45.76c for spot cotton on March 3, 1951. (a) Trading suspended during February.

Production Index for the Rubber Industry

(1947-1949 = 100)

(Based on man-hours)

	1955	1956	1957		1955	1956	1957
Jan.	145	147	145	July	137	125	133
Feb.	144	140	145	Aug.	138	135	...
Mar.	146	135	142	Sept.	142	132	...
Apr.	147	136	131	Oct.	147	134	...
May	146	127	130	Nov.	147	126	...
June	149	120	129	Dec.	144	137	...

Sales by the Rubber Industry

(in Millions of Dollars*)

	1955	1956	1957		1955	1956	1957
Jan.	424	415	496	July	471	459	514
Feb.	440	445	495	Aug.	456	436	...
Mar.	466	451	476	Sept.	456	429	...
Apr.	445	445	490	Oct.	447	454	...
May	465	464	481	Nov.	482	463	...
June	465	450	458	Dec.	465	461	...

Rubber Manufacturers' Inventories

(in Millions of Dollars*)

	1955	1956	1957		1955	1956	1957
Jan.	790	935	1,047	July	853	987	1,045
Feb.	782	970	1,036	Aug.	863	1,007	...
Mar.	805	979	1,030	Sept.	874	1,007	...
Apr.	784	970	1,031	Oct.	902	1,022	...
May	810	985	1,024	Nov.	935	1,024	...
June	850	975	1,027	Dec.	934	998	...

Source: U. S. Department of Commerce.
Notes: * Adjusted for seasonal variation.

No. 1 R.S.S.—Annual Average Prices

(New York Market—Cents per Pound)

Year	High	Low	Avg.	Year	High	Low	Avg.
1915	79	58½	65.85	1936	23	13½	16.41
1916	102	55	72.50	1937	26⅞	14	19.39
1917	90	52	72.23	1938	17⅞	10¼	14.64
1918	70	40	60.15	1939	24	14⅛	17.57
1919	57	38½	48.70	1940	24	18¼	20.10
1920	56½	16	36.30	1941	24⅞	19⅛	22.40
1921	21¼	11½	16.36	1942	22½	22½	22.50
1922	28⅜	13⅝	17.50	1943	22½	22½	22.50
1923	37½	24¾	29.45	1944	22½	22½	22.50
1924	40⅞	17⅜	26.20	1945	22½	22½	22.50
1925	121	34⅜	72.46	1946	22½	22½	22.50
1926	88½	36¾	48.50	1947	25	14	20.00
1927	41¾	33	37.72	1948	25	18	21.99
1928	41¼	17	22.48	1949	19¾	15⅞	17.57
1929	26⅞	15½	20.55	1950	86	18	41.10
1930	16½	7½	11.98	1951	76	52	(a)
1931	8⅝	4¼	6.17	1952*	33	26½	29.15
1932	4¾	2½	3.49	1953	31⅞	19⅜	24.21
1933	9⅞	2⅞	5.96	1954	34½	19½	23.61
1934	15⅞	8¾	12.92	1955	52	29⅜	39.16
1935	13¾	10½	12.37	1956	45	26½	34.24

Note: Price was fixed by Government on August 6, 1941, at 22½c a pound for non-war uses. Free trading was resumed May 1, 1947. (a) Free trading suspended March 31, 1951. GSA selling price ranged between 52 and 66c during balance of year. * Free trading was resumed on July 1, 1952; figures represent only July through December, 1952.

No. 1 R.S.S.—Monthly Average Prices

(New York Market—Cents per pound)

	1950	1951	1952	1953	1954	1955	1956	1957
Jan.	18.33	71.21	....	29.40	20.22	33.92	41.70	33.32
Feb.	19.40	73.61	....	27.57	19.98	34.90	33.68	30.43
Mar.	19.86	72.05	....	26.59	20.16	31.08	33.68	31.76
Apr.	23.51	....	....	24.66	22.06	31.75	31.74	32.23
May	28.07	....	....	25.52	21.96	31.35	29.61	32.12
June	30.92	....	....	24.42	23.01	34.74	30.54	32.80
July	39.10	....	30.52	23.64	24.12	40.84	33.91	32.88
Aug.	51.63	....	29.36	23.36	23.26	45.85	35.69	32.13
Sept.	55.98	....	27.42	23.06	23.99	48.27	32.64	29.94
Oct.	62.19	....	27.26	20.82	26.57	43.81	32.68	29.24
Nov.	73.05	....	29.25	20.58	28.07	44.95	35.18	....
Dec.	71.20	....	31.26	20.92	29.88	48.40	37.01	....
Average for Year	41.10	(*)	29.15	24.21	23.61	39.16	34.24	....

Note: (*) Free trading suspended March 31, 1951, and resumed on July 1, 1952.

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Write for Bulletin #463

JOHN ROYLE & SONS

ROYLE PATERSON N. J. 1880

PIONEERED THE CONTINUOUS EXTRUSION PROCESS IN

London, England	Home Office	Akron, Ohio	Los Angeles, Cal.	Tokyo, Japan
James Day (Machinery) Ltd.	V. M. Hovey J. W. VanRiper	J. C. Clinefelter	H. M. Royal, Inc.	Okura Trading Co., Ltd.
Hyde Park 2430 - 0456	SHerwood 2-8262	BLackstone 3-9222	LUdlow 9-3261	(56) 2130 - 2149

Automotive Pneumatic Casings

(Thousands of Units)

	Shipments					
	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1951 (total)	32,153	44,612	1,677	78,442	83,405	8,765
Passenger Car	26,729	34,226	723	61,678	65,546	6,973
Truck and Bus	5,424	10,386	954	16,764	17,859	1,791
1952 (total)	29,484	54,342	1,520	85,346	90,411	14,110
Passenger Car	24,106	45,458	741	70,305	74,341	11,251
Truck and Bus	5,378	8,884	779	15,041	16,070	2,859
1953 (total)	37,949	55,124	1,543	94,617	96,150	15,720
Passenger Car	33,106	45,798	809	79,713	81,455	13,044
Truck and Bus	4,843	9,326	734	14,904	14,696	2,676
1954 (total)	33,333	55,155	1,753	90,241	89,141	14,762
Passenger Car	29,741	47,044	928	77,713	76,794	12,217
Truck and Bus	3,591	8,111	826	12,528	12,347	2,545
1955 (total)	47,374	59,246	1,879	108,499	112,178	18,778
Passenger Car	42,574	50,189	966	93,730	97,223	15,963
Truck and Bus	4,800	9,057	912	14,769	14,955	2,815
1956 (total)	35,422	62,146	1,757	99,325	100,406	79,872
Passenger Car	30,873	53,252	875	85,000	85,546	16,494
Truck and Bus	4,548	8,894	883	14,325	14,859	3,378
1956:						
July (total)	2,833	6,319	145	9,298	6,741	17,394
Passenger Car	2,471	5,482	73	8,026	5,668	14,088
Truck and Bus	362	837	72	1,271	1,073	3,306
Aug. (total)	2,302	6,178	163	8,644	8,050	16,794
Passenger Car	1,953	5,359	77	7,389	6,897	13,578
Truck and Bus	349	819	86	1,254	1,153	3,217
Sept. (total)	1,553	5,238	162	6,952	7,800	17,648
Passenger Car	1,261	4,427	70	5,758	6,647	14,468
Truck and Bus	291	811	92	1,194	1,153	3,180
Oct. (total)	2,908	4,703	165	7,776	8,799	18,775
Passenger Car	2,530	3,854	87	6,471	7,526	15,607
Truck and Bus	378	849	78	1,305	1,273	3,168
Nov. (total)	3,516	3,881	121	7,518	7,641	18,803
Passenger Car	3,179	3,255	62	6,496	6,580	15,596
Truck and Bus	337	626	59	1,022	1,060	3,207
Dec. (total)	3,579	3,803	166	7,548	8,556	19,872
Passenger Car	3,277	3,220	90	6,587	7,425	16,494
Truck and Bus	301	583	76	961	1,130	3,378
1957:						
Jan. (total)	3,496	5,195	183	8,874	9,504	20,490
Passenger Car	3,192	4,519	99	7,810	8,296	16,978
Truck and Bus	305	677	83	1,065	1,208	3,512
Feb. (total)	3,361	5,051	127	8,539	9,169	21,008
Passenger Car	3,017	4,453	68	7,538	8,047	17,376
Truck and Bus	344	598	59	1,001	1,122	3,633
Mar. (total)	3,381	5,579	154	9,114	9,766	21,743
Passenger Car	3,051	4,875	80	8,007	8,630	18,068
Truck and Bus	340	704	74	1,107	1,136	3,675
Apr. (total)	3,246	5,989	146	9,381	8,950	21,308
Passenger Car	2,809	5,218	78	8,104	7,878	17,821
Truck and Bus	438	770	69	1,277	1,072	3,486
May (total)	3,230	5,786	134	9,151	9,490	21,630
Passenger Car	2,831	5,166	60	8,057	8,312	18,050
Truck and Bus	399	620	74	1,094	1,178	3,580
June (total)	2,993	6,191	127	9,310	8,489	20,783
Passenger Car	2,623	5,476	63	8,162	7,462	17,322
Truck and Bus	370	715	64	1,148	1,027	3,461
July (total)	3,068	6,646	126	9,840	8,443	19,316
Passenger Car	2,719	5,826	65	8,611	7,449	16,097
Truck and Bus	349	819	61	1,229	994	3,219
Aug. (total)	3,214	6,488	130	9,833	8,917	18,477
Passenger Car	2,886	5,675	66	8,627	7,801	15,348
Truck and Bus	328	813	65	1,206	1,117	3,129

Source: The Rubber Manufacturers Association, Inc.

Automobile Production in U. S.

(Civilian Production Only)

Year	Passenger Cars	Trucks	Total	Year	Passenger Cars	Trucks	Total
1937	3,915,889	892,382	4,808,271	1947	3,558,178	1,220,634	4,778,812
1938	2,000,985	485,852	2,486,837	1948	3,909,270	1,363,856	5,273,126
1939	2,866,796	704,308	3,571,104	1949	5,108,841	1,123,736	6,232,577
1940	3,692,328	721,637	4,413,965	1950	6,665,836	1,332,263	7,998,099
1941	3,744,500	875,381	4,619,681	1951	5,337,729	1,420,432	6,758,161
1942	220,814	133,083	353,897	1952	4,320,794	1,212,790	5,533,584
1943	0	4,501	4,501	1953	6,121,787	1,202,196	7,323,983
1944	0	124,819	124,819	1954	5,558,897	1,038,045	6,596,942
1945	83,792	313,643	397,435	1955	7,920,186	1,245,018	9,165,204
1946	2,148,699	930,760	3,079,429	1956	5,816,109	1,100,417	6,916,526
1956:							
Jan.	591,032	98,968	690,000	July	440,980	80,731	521,711
Feb.	560,924	102,384	663,308	Aug.	417,020	85,827	502,847
Mar.	583,169	106,379	689,548	Sept.	203,888	71,299	275,187
Apr.	552,881	101,081	653,962	Oct.	352,140	92,684	444,824
May	474,010	96,114	570,124	Nov.	576,708	90,246	666,954
June	445,758	91,791	537,549	Dec.	617,599	82,913	700,512
1957:							
Jan.	628,045	91,117	719,162	July	484,718	94,924	579,642
Feb.	570,023	91,767	661,790	Aug.	521,282	89,150	610,432
Mar.	585,734	91,703	676,437	Sept.	318,279	62,087	380,366
Apr.	541,733	105,175	646,908	Oct.	.....	.....	.....
May	537,112	102,312	639,424	Nov.	.....	.....	.....
June	496,329	94,321	590,650	Dec.	.....	.....	.....

Source: Automobile Manufacturers Association.
Note: Figures are based on factory sales. Revisions are made from time to time in these figures and the latest issue should be consulted for accuracy.

Automotive Inner Tubes

(Thousands of Units)

	Shipments					
Year	Original Equipment	Replacement	Export	Total	Production	Inventory End of Period
1946	15,327	59,357	1,424	76,108	77,251	3,820
1947	25,046	46,560	2,483	74,088	79,181	8,059
1948	26,833	40,548	1,119	68,499	70,033	9,641
1949	31,521	31,450	887	63,858	65,114	10,657
1950	41,240	42,671	811	84,723	80,179	..
1951	32,151	32,284	1,071	65,507	67,249	10,094
1952	29,451	32,985	1,014	63,449	65,073	12,036
1953	37,957	36,072	878	74,907	74,425	11,874
1954	25,071	35,576	945	61,593	48,279	9,519
1955	5,001	33,387	1,001	39,389	35,900	6,833
1956	3,100	32,358	1,040	36,498	34,405	6,109
1956:						
Dec.	235	2,515	87	2,837	2,670	6,109
1957:						
Jan.	234	3,494	101	3,829	3,364	5,789
Feb.	267	2,964	61	3,291	3,362	5,960
Mar.	240	3,058	100	3,397	3,822	6,540
Apr.	311	2,708	85	3,104	3,428	6,969
May	301	2,829	84	3,214	3,548	7,422
June	275	3,128	69	3,472	3,025	6,946
July	258	3,364	86	3,708	2,941	6,287
Aug.	243	3,358	82	3,683	3,134	5,966

Source: The Rubber Manufacturers Association, Inc.

Vinyl and Vinyl Copolymer Resins—Sales

(Thousands of Pounds—Resin Content)

	Polyvinyl Chloride and Copolymer Resins							All Other Vinyl Resins		
	Film	Sheeting	Molding & Extrusion	Textile & Paper Treating	Flooring	Protective Coatings	All Other Uses	Adhesives	All Other Uses	Grand Total
1953	63,691	62,385	129,215	52,353	22,152	22,823	27,790	22,411	77,478	480,299
1954	69,943	56,588	147,284	49,546	34,890	23,676	35,148	26,609	74,090	517,773
1955	83,276	51,424	183,736	64,223	56,357	27,439	53,868	31,853	105,644	657,821
1956	78,063	55,598	206,726	62,931	65,384	28,522	71,859	36,565	115,151	720,799
1956:										
July	4,722	3,714	15,203	4,298	4,231	2,681	2,321	3,165	8,146	48,481
Aug.	6,497	4,787	17,490	5,727	6,798	2,416	7,228	3,256	9,213	63,412
Sept.	7,159	4,194	17,228	5,198	5,526	2,025	5,945	2,893	9,291	59,458
Oct.	8,581	5,341	21,339	6,384	6,790	2,568	5,984	3,231	10,773	70,992
Nov.	7,002	4,774	19,895	5,888	6,253	2,639	6,128	3,115	10,242	65,936
Dec.	5,829	3,990	18,279	5,416	5,810	2,672	7,063	2,429	9,297	60,785
1957:										
Jan.	8,094	5,761	18,505	6,197	5,958	3,077	3,438	2,988	10,408	64,426
Feb.	8,669	4,564	19,805	5,137	6,221	2,682	3,258	3,255	9,529	63,120
Mar.	8,589	5,272	20,792	5,440	6,879	2,798	4,173	3,372	10,060	67,375
Apr.	7,036	4,191	18,393	4,616	7,890	3,495	4,254	4,211	8,975	63,061
May	7,641	3,765	18,218	4,628	7,519	3,227	4,388	3,404	10,371	63,161
June	7,098	3,861	17,195	4,688	6,245	2,362	3,791	4,467	9,851	59,558
July	6,342	4,362	14,340	5,371	6,030	2,755	2,872	3,236	7,976	53,284
Aug.	7,121	4,941	17,962	6,884	7,553	2,515	4,252	3,677	9,011	63,916

Source: Chemical Division, U. S. Tariff Commission.

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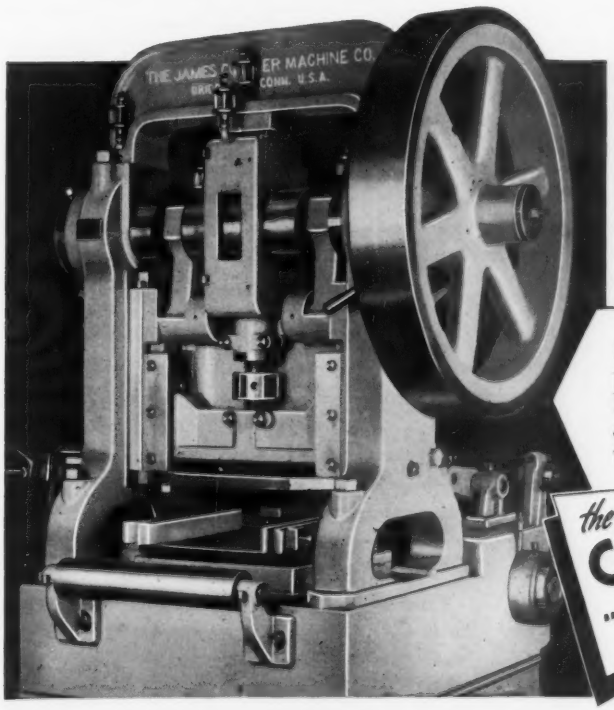

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Various Compounding Materials Consumed by the Rubber Industry

Material	1949	1950	1951	1952	1953	1954	1955
Antimony, Primary:							
Short tons	55	103[c]	19[c]	66[c]	20[c]	49[c]	45[c]
% of total	.005	.007	.001	.004	.001	.004	.004
Asphalt: [a]							
Short tons	18,050	26,819	21,414	33,288	.....	.....	.....
% of total	0.3	0.3	0.3	0.4	.....	.....	.....
Barite (Barytes):							
Short tons	14,000	19,000	15,000	18,000	21,000	20,000	.....
% of total	2.53	3.31	2.13	2.0	2.0	2.0	.....
Carbon Black:							
Short tons	383,565	515,184	530,614	537,273	566,797	511,813	643,430
% of total	93.3	92.9	93.9	93.1	94.4	...	93.7
Clay, Kaolin:							
Short tons	197,341	263,306	231,331	240,982	241,052	247,431	.....
% of total	13.1	15.0	12.7	13.2	12.8	13.2	.....
Clay, Fire & Stoneware:							
Short tons	27,148	9,500	.....	9,322	18,475	8,781	.....
% of total	0.3	0.1	.....	0.1	.2	.1	.....
Lime:							
Short tons	715	908	1,126	2,000	1,631	1,555	.....
% of total	.0002	.0002	[d]	[d]	[d]	[d]	.....
Litharge:							
Short tons	1,398	3,047	2,641	2,109	2,230	1,768	.....
% of total	1.2	1.7	1.7	1.5	1.4	1.3	.....
Lithopone:							
Short tons	3,245	4,092	3,295	1,523	1,723	1,701	2,163
% of total	4.1	3.9	3.2	2.5	3.3	3.9	5.0
Mica, Ground:							
Short tons	3,856	5,776	6,551	5,126	5,668	5,021	.....
% of total	7.0	8.0	9.0	7.0	7.8	6.3	.....
Sulfur:							
Short tons	59,360	75,000	75,000	75,000	80,000	.....	.....
% of total	1.3	1.3	1.4	1.4	1.4	.....	.....
Talc: [b]							
Short tons	53,400	75,900	70,970	64,476	32,137	30,621	.....
% of total	12.0	12.0	11.2	10.9	0.7	.07	.....
Zinc Oxide:							
Short tons	58,496	82,944	71,507	72,774	78,439	71,058	86,677
% of total	52.5	51.6	48.4	51.2	52.7	50.7	51.5

Source: U. S. Bureau of Mines.
Notes: (a) Solid and semi-solid products of less than 200 penetration. (b) Includes prophyllite and ground soapstone. (c) Does not include precipitated antimony sulfide as in previous years. (d) Negligible.

Reclaimed Rubber

(Including Natural and Synthetic)

(All Quantities in Long Tons)

Year	New Supply	Consumption: Tons	Consumption: % to Crude [a]	Exports	Stocks On Hand at End of Period
1941	274,202	251,231	32.2	13,851	41,750
1942	286,007 [b]	254,820	64.6	30,405	42,532
1943	304,058 [c]	291,082	59.6	15,678	46,201
1944	260,631 [d]	251,083	35.3	11,800	43,832
1945	243,309	241,036	30.2	13,413	28,155
1946	295,612	275,410	26.5	14,461	33,666
1947	291,395	288,395	24.8	14,556	35,943
1948	266,861	261,113	24.4	11,428	32,630
1949	224,029	226,679	22.5	10,637	28,263
1950	314,008	303,733	24.1	11,740	35,708
1951	366,700	346,121	26.6	14,722	45,082
1952	274,981	280,002	22.2	11,180	30,664
1953	298,336	285,050	21.3	11,597	32,319
1954	258,101	249,049	20.2	10,232	30,746
1955	326,649	312,781	20.4	13,988	31,498
1956	287,220	270,547	18.8	13,832	34,969
1956:					
Aug.	21,724	21,498	18.0	1,076	35,512
Sept.	22,368	20,242	17.9	1,015	36,527
Oct.	26,318	23,946	17.8	1,298	37,904
Nov.	20,009	20,832	18.2	1,189	36,063
Dec.	20,673	20,737	17.7	902	34,969
1957:					
Jan.	25,103	24,053	17.5	1,288	34,552
Feb.	21,896	22,773	18.4	1,263	32,010
Mar.	25,088	24,633	19.0	1,298	30,975
Apr.	22,878	23,145	19.0	1,201	30,258
May	24,884	23,816	18.8	1,277	29,847
June	22,402	21,352	19.1	1,083	30,379
July	20,469	19,676	18.1	757	29,972
Aug.	20,411	22,346	18.0	....	28,471

Source: U. S. Department of Commerce.
Notes: (1) These figures are revised from time to time and the latest available issue should be consulted for the most accurate data. (a) Includes natural and synthetic rubber. (b) Includes 893 tons of imports. (c) Includes 67 tons of imports. (d) Includes 21 tons of imports.

Cotton, Rayon and Nylon Tire Fabrics

(In Thousands of Pounds)

	Production: Rayon Tire Cord Not Woven	Production: Rayon Tire Cord Woven	Production: Cotton and Nylon Cord & Fabric [a]	Production: Chafer Fabrics (all fibers)	Production: Total Tire Cord and Fabric	Stocks [b]: Cotton and Nylon Cord & Fabric	Stocks [b]: Rayon Cord and Fabric
1956:							
Jan.-Mar.	23,707	74,833	29,298	14,176	129,199	10,185	48,936
Apr.-June	21,557	60,644	28,752	11,628	112,546	10,433	43,737
July-Sept.	18,698	56,961	26,349	7,958	102,575	11,094	44,376
Oct.Dec.	20,071	55,655	28,493	9,497	104,921	12,500	38,060
Total	84,033	248,093	112,892	43,259	449,241	44,212	175,109
1957:							
Jan.-Mar.	21,853	68,825	31,393	11,028	123,182	11,844	37,153
Apr.-June	16,037	63,195	35,308	10,456	115,418	13,428	41,769
July-Sept.	.....	.....	.....	.....	.....	.....	.....
Oct.-Dec.	.....	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....	.....

Source: Bureau of the Census, U. S. Department of Commerce.
Notes: (a) Combined to avoid disclosing figures for individual companies. (b) At end of period.

Gasoline Consumption

(In Thousands of Barrels of 42 Gallons)

	1951	1952	1953	1954	1955	1956	1957
Jan.	80,670	86,863	89,634	89,852	96,397	100,642	109,295
Feb.	72,864	82,043	86,458	86,206	88,464	98,088	96,694
Mar.	86,962	87,065	98,158	101,549	105,684	112,412	113,166
Apr.	87,573	98,563	102,044	103,866	111,116	113,034	115,820
May	100,266	101,137	105,918	104,418	115,707	123,560	124,325
June	96,364	99,305	114,703	113,037	120,710	126,838	121,598
July	100,567	105,307	112,969	112,231	115,653	120,708	130,251
Aug.	101,453	102,954	109,124	110,223	121,816	125,847	.....
Sept.	91,891	100,095	106,158	104,706	113,379	111,574	.....
Oct.	100,209	103,689	106,037	105,607	112,558	119,204	.....
Nov.	88,581	91,326	99,210	102,393	109,212	112,113	.....
Dec.	84,551	95,817	100,225	104,258	111,034	108,096	.....
Total	1,091,951	1,154,254	1,230,629	1,238,346	1,321,730	1,372,116	.....

Source: U. S. Bureau of Mines.

U. S. Gross Imports of Balata, Jelutong, Gutta-Percha, etc.

(All Quantities in Long Tons)

Year	Balata: Tons	Balata: Value	Jelutong: Tons	Jelutong: Value	Gutta-Percha & Other Guttas: Tons	Gutta-Percha & Other Guttas: Value
1945	1,361	907,253	....	.....	36	21,970
1946	2,281	2,233,065	304	256,169	423	458,064
1947	1,982	2,276,531	2,878	1,496,887	392	779,591
1948	1,195	805,078	3,401	2,377,765	423	542,788
1949	1,391	814,554	1,043	834,978	197	189,021
1950	2,117	1,589,885	1,789	1,515,162	541	745,418
1951	2,452	1,973,271	1,669	2,608,359	383	430,539
1952	988	762,994	1,636	2,094,983	282	385,890
1953	1,619	866,248	1,027	1,166,837	235	303,116
1954	949	504,065	2,196	2,624,926	417	511,055
1955	1,022	967,369	1,679	1,731,821	284	318,115
1956	1,396	1,111,165	1,851	1,909,447	290	309,615
1956:						
Sept.	195	165,793	103	127,682	5	10,199
Oct.	232	181,337	158	155,523	23	19,254
Nov.	232	194,511	116	144,945	74	45,853
Dec.	111	58,952	217	234,224	38	30,131
1957:						
Jan.	38	17,911	141	155,467	15	10,684
Feb.	12	12,191	117	130,001	22	27,792
Mar.	89	51,830	150	178,499	16	7,894
Apr.	167	100,490	134	160,369	28	23,714
May	201	116,150	192	225,257	69	87,987
June	36	17,426	130	134,438	22	35,112
July	33	15,195	161	185,524	28	32,282

Source: U. S. Department of Commerce.

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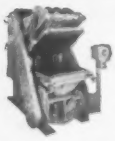

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"Equipment for Sale" continued on next page

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Index to Advertisers

Adamson United Co. 235
Aetna-Standard Engineeirng Co. 261
Akron Rubber Machinery Co. 376
Albert, L., & Son 376
Alco Oil & Chemical Corp. 344
Allied Chemical & Dye Corp. 225, 333
American Cyanamid Co.
Intermediate & Rubber Chemicals Dept. .. 341
Pigments Div. ..... —
American Synthetic Rubber Corp. ..... —
American Viscose Corp. ..... —
American Zinc Sales Co. 207
Ames, B. C., Co. ..... —
Amoco Chemicals Corp. ..... —
Argus Chemical Corp. ..... —
Askania Regulator Co. 365
Atlas Electric Devices Co. 232
Atlas Hydraulics, Inc. ..... —

Bakelite Co., Div. Union Carbide Corp. ..... —
Barrett Div., Allied Chemical & Dye Corp.... 333
Bedford-Bolling Co., Inc. 376
Bell Kaolin ..... —
Bestread Products Co. 372
Black Rock Manufacturing Co. ..... —
Bolling, Stewart & Co., Inc. ..... —
Borg-Warner Corp., Marbon Chemical Div. ... 209
Brockton Cutting Die & Machine Co., Inc..... —
Brooklyn Color Works, Inc. 373
Brown Co. ..... —

Cabot, Godfrey L., Inc. 241, 254
Cadillac Associates, Inc. 371
Cambridge Instrument Co., Inc. 353
Carey, Philip, Manufacturing Co. 346
Carter Bell Manufacturing Co. 234
Cary Chemicals, Inc. ..... —
Catalin Corp. of America ..... —
Cellusuede Products, Inc. 373
Century Products Co. 373
Chemical Publishing Co., Inc. 369
CLASSIFIED ADVERTISING 371-76
Cleveland Liner & Manufacturing Co. 258
Columbia-Southern Chemical Corp. ..... —
Columbian-Carbon Co. .....Insert Following 306
Concord Mica Corp. 372
CONSULTANTS SECTION 374
Continental Carbon Co.
Insert Following 324, Back Cover
Continental Machinery Co., Inc. 350
Copolymer Rubber & Chemical Corp.
Insert Following 342
Coulter, James, Machine Co. 369
Cumberland Engineering Co., Inc. ..... —
Custom Engineering Co. 376
Cylinder Manufacturing Co., Inc. 372

D. P. R. Inc. 345
Darlington Chemicals, Inc. 342
Davis-Standard Div., Franklin Research Corp... 259
Day, J. H., Co. 208
Dayton Rubber Co. 346
Diamond Alkali Co. ..... —
Disco, Inc. ..... —
Dow Corning Corp. 248-49, 252
Drake Personnel, Inc. 371
Du Bois Co., Inc. 338
du Pont de Nemours, E. I. & Co., Inc.
Elastomer Chemicals Dept. .....Second Cover
Durez Plastics Div.,
Hooker Electrochemical Co. ..... —

Eastman Chemical Products Inc. 203
Eastman Machine Co. 347
Emerson Apparatus Co. 353
Emery Industries, Inc. 228-29
Endura Corp. 340
English Mica Co. ..... —
Enjay Co., Inc. 331
Erie Engine & Manufacturing Co. 357
Erie Foundry Co. 216

Falls Engineering & Machine Co. ..... —
Farrel-Birmingham Co., Inc. ..... —
Fasson Products ..... —
Ferry Machine Co. 357
Fink, F. J., Co. 342
Flexo Supply Co., Inc. 372
Franklin Research Corp., Davis-Standard Div. 259
French Oil Mill Machinery Co. 230

Gammeter, W. F., Co. 347
General Electric Co., Silicone Products Dept. —
General Magnesite & Magnesia Co. ..... —
General Porcelain Manufacturing Co. 246
General Tire & Rubber Co., Chemical Div..... 244-45
Genseke Brothers, Rubber Materials Div..... 253
Glas-Col Apparatus Co. 262
Glidden Co., Chemicals-Pigments-Metals Div... —
Goodman, G. F., & Son 347
Goodrich, B. F., Chemical Co. 201
Goodrich-Gulf Chemicals, Inc. 226
Goodyear Tire & Rubber Co.
Chemical Div. .....Insert 217, 218, 219
Gummi und Asbest ..... —

Hale & Kullgren, Inc. 261, 374
Hall, C. P., Co. 337
Harshaw Chemical Co. 231
Harwick Standard Chemical Co..... 273
Heinemann, F., Saw Corp. of Canton 270
Hoggson & Pettis Manufacturing Co. ..... —
Holliston Mills, Inc. ..... —
Hooker Electrochemical ..... —
Holmes, Stanley H., Co. ..... —
Houston Rubber Machine Co. 374
Howe Machinery Co., Inc. 376
Huber, J. M., Corp. 204

Independent Die & Supply Co. 340
Industrial Div., Pennsalt Chemicals Corp. .... —
Industrial Ovens, Inc. 349
Institution of the Rubber Industry 352

Johnson Corp. 348
Johnson Machinery Co. 375
Johnson Steel & Wire Co., Inc. ..... —

K. B. C. Industries, Inc. 372
Kautschuk und Gummi 373
Kenrich Corp. 210
Kingsbacher-Murphy Co. 365

La Goma ..... —
Lambert, E. P., Co. 357
Lehmann, J. M., Co., Inc. 264
Leon Machine & Engineering Co. 339
Linde Co., Div. Union Carbide Corp. 271
Litzler, C. A., Inc. 345

Marbon Chemical Div., Borg-Warner Corp. ... 209
Marchionna, Dr. Frederick 374
Marine Magnesium Div. ..... —
Maryland Cork Co., Inc. 372
McNeil Machine & Engineering Co. 372
Merck & Co., Inc. ..... —
Midwest Rubber Reclaiming Co. ..... —
Minnesota Mining & Manufacturing Co. 212-13
Monsanto Chemical Co.
Rubber Chemicals Dept. 243
Mount Vernon Mills, Inc. ..... —
Muehlstein, H., & Co., Inc. 329

National Aniline Div., Allied Chemical &
Dye Corp. 225
National Chemical & Plastics Co. ..... —
National Rosin Oil Products, Inc. ..... —
National Rubber Machinery Co. ..... —
National Standard Co. 214
Naugatuck Chemical Division,
U. S. Rubber Co. 215, 274
Nelson Employment Service 371
Neville Chemical Co. 247
New Jersey Zinc Co. 242

Olin Mathieson Chemical Corp. ..... —
Olin, R. R., Laboratories 374

Paterson Parchment Paper Co. 206
Pelmor Laboratories Inc. ..... —
Pennsylvania Industrial Chemical Corp. ..... —
Pequanoc Rubber Co. 372
Petro-Tex Corp. ..... —
Phillips Chemical Co.
Philblack 202
Philprene 269
Pierce Wrapping Machine Co. ..... —
Pittsburgh Steel Co. ..... —
Plandex Corp. 334
Polymer Corp., Ltd. 335
Progressive Service Co. 355
Pure Carbonic Co. 354

Rand Rubber Co. 372
Randall, Frank E., Co., Inc. 339
Rare Metal Products Co. ..... —
Reliable Rubber & Plastic Machinery Co. 374
Revue Générale du Caoutchouc ..... —
Rhodia, Inc. ..... —
Richardson, Sid, Carbon Co. 378
Ross, Charles, & Son Co., Inc. 336
Royal Rubber Co. ..... —
Royle, John, & Sons 367
Rubber Corp. of America 369
Rubber Age Books 237, 340, 260
Rubber Journal ..... —

St. Joseph Lead Co. 268
Sargent's, C. G., Sons Corp. ..... —
Schulman, A., Inc. .....Third Cover
Scott Testers, Inc. 347
Shaw, Francis & Co., Ltd. 250
Shell Chemical Corp., Synthetic Rubber
Sales Div. 222
Shell Oil Co., Inc. .....Insert Following 256
Sherman Rubber Machinery Co. Div. 374
Shiraishi Kogyo Kaisha, Ltd. 373
Shore Instrument Co. 348
Siempelkamp, G., & Co. ..... —
Sinclair-Collins Valve Co. 220
Skinner Engine Co. 233
Snell, Foster D., Inc. 374
South Florida Test Service 374
South Texas Tire Test Fleet, Inc. ..... —
Southeastern Clay Co. ..... —
Southern Clays, Inc. 272
Spadone Machine Co. ..... —
Stamford Rubber Supply Co. 365
Stauffer Chemical Co., Inc. 265
Sticht, Herman H., Co., Inc. 345
Stoner's Ink Co. 369
Sun Oil Co. .....Insert 238-39, 263

Tapper, William 376
Taylor-Emmett Controls, Inc. ..... —
Taylor Instrument Companies ..... —
Taylor-Stiles & Co. 236
Testing Machines Inc. ..... —
Texas-U. S. Chemical Co. 221
Texo Corp. ..... —
Thiokol Chemical Corp. 266-67
Thomaston Mills 351
Thropp, William R., & Sons 264
Tipptronic, Inc. 351
Titanium Pigment Corp. ..... —
Trade News Service 374
Turner Halsey Co. ..... —

Union Carbide Corp. 271
United Carbon Co., Inc.....Insert Following 360
United Clay Mines Corp. ..... —
United Engineering & Foundry Co. 211
United Rubber Machinery Exchange 376
U. S. Rubber Co., Naugatuck Chemical Div. 215, 274
U. S. Rubber Reclaiming Co., Inc. ..... —
Universal Oil Products Co. 251
Utility Manufacturing Co. 354

Vanderbilt, R. T., Co. .....Front Cover
Velsicol Chemical Corp. 255
Victor Manufacturing & Gasket Co. 332

Wellington Sears Co. 256
Western Supplies Co. 350
White, J. J., Products Co. 367
Whittaker Clark & Daniels, Inc. 355
Williams, C. K., & Co., Inc. ..... —
Witco Chemical Co. Insert Following 324, Back Cover
Woloch, George, Co., Inc. 339
Wood, R. D., Co. 227

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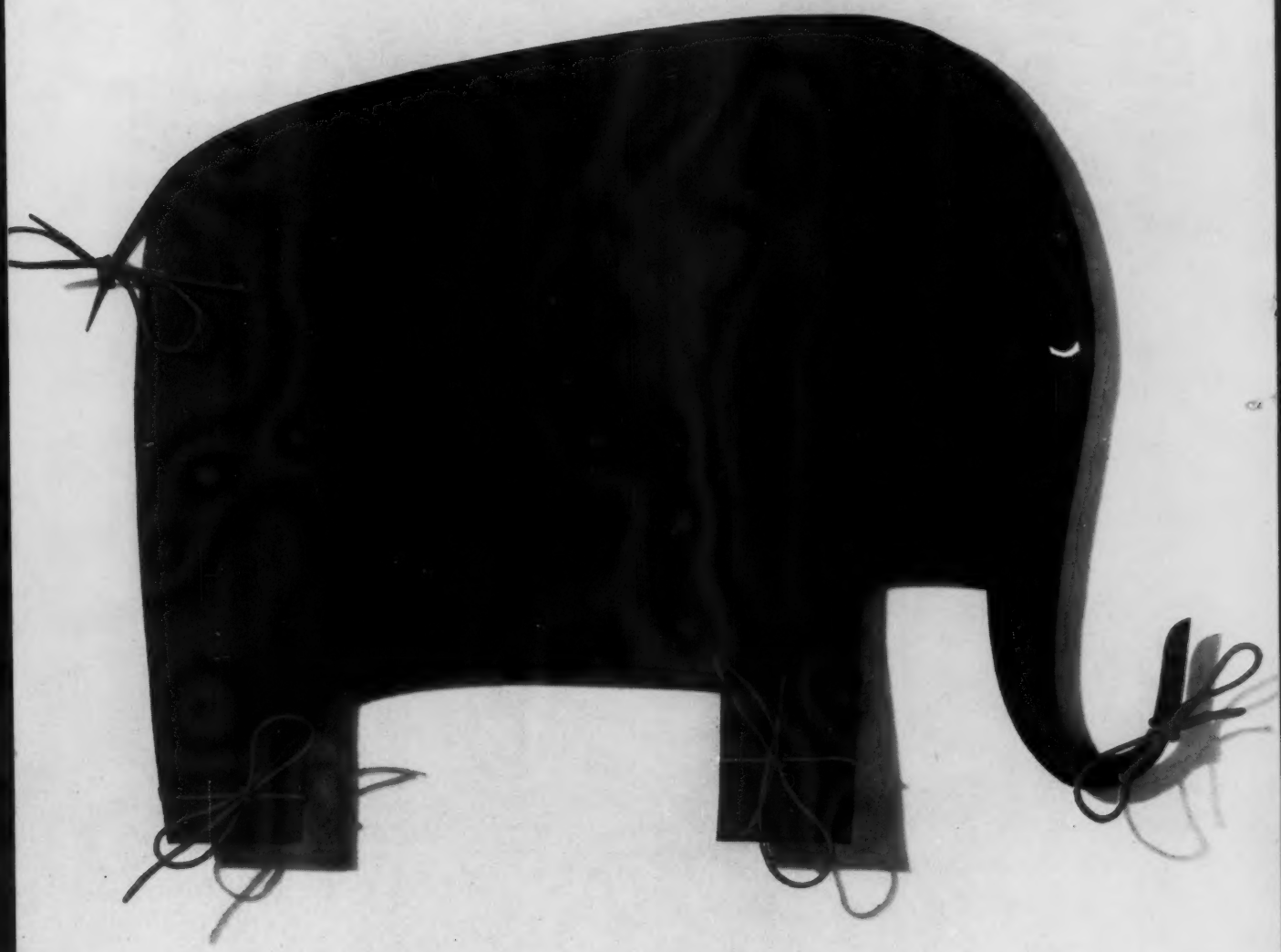

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In This Issue

Radiation and Rubber

How Gamma Radiation Effects Heat-Resistant Elastomers (second of a series)

page 461

Rubber-to-Metal Adhesion page 478

Adhesive Films

Relation between surface configuration and good adhesive qualities

page 471

Special Report

Executive Compensation in the Rubber Industry

page 489

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